King County International Airport
(Boeing Field)

Design Report

RUNWAY 13L – 31R REHABILITATION

AIP No. 3-53-0058-26

June 2001

Prepared by

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File No. 23-00-009-001-01

Attachment 1

SPONSOR CERTIFICATION FOR SELECTION OF CONSULTANTS

King County	King County International Airport	3-53-0058-26
Sponsor's Name	Airport	Project Number

Runway 13L-31R Rehabilitation
Project Description

Section 509(d) of the Airport and Airway Improvement Act of 1982, as amended (herein called the Act), authorizes the Secretary to require certification from sponsors that they will comply with statutory and administrative requirements. The following list of certified items includes major requirements for this aspect of project implementation. However, the list is not comprehensive, nor does it relieve sponsors from fully complying with all applicable statutory and administrative standards. Every certified item must be marked. Each certified item with a "no" response must be fully explained in an attachment to this certification. If the item is not applicable to this project, mark the item "N/A," General procurement standards for consultant services within Federal grant programs are described in 49 CFR 18.36. Sponsors may use other qualifications-based procedures provided they are equivalent to specific standards in 49 CFR 18 and Advisory Circular 150/5100-14.

1. Advertisements were placed to ensure fair and open competition from a wide area of interest.
Yes _X_ No___ N/A___

2. For contracts over $25,000, consultants were selected using competitive procedures based on qualifications, experience, and disadvantaged business enterprise requirements with the fee determined through negotiation.
Yes _X_ No___ N/A___

3. An independent cost analysis was performed, and a record of negotiations has been prepared reflecting the considerations involved in the establishments of fees. Yes _X_ No___ N/A___

4. If engineering or other services are to be performed by sponsor force account personnel, prior approval was obtained from FAA. Yes _X_ No___ N/A___

5. The consultant services contracts clearly establish the scope of work and delineate the division of responsibilities between all parties engaged in carrying out elements of the project. Yes _X_ No___ N/A___

6. Costs associated with work ineligible for AIP funding are clearly identified and separated from eligible items.
Yes _X_ No___ N/A___

7. All mandatory contract provisions for grant-assisted contracts have been included in all consultant services contracts.
Yes _X_ No___ N/A___

8. If the contract is awarded without competition, pre-award review and approval was obtained from FAA.
Yes __ No___ N/A_X_

9. Cost-plus-percentage-of-cost methods of contracting prohibited under Federal standards were not used.
Yes _X_ No___ N/A___

10. If the services being procured cover more than the single grant project referenced in this certification, the scope of work was specifically described in the advertisement, and future work will not be initiated beyond three years.
Yes __ No___ N/A_X_

I certify that, for the project identified herein, the responses to the foregoing items are correct as marked, and that the attachments, if any, are correct and complete.

Signed: Cynthia Stewart Dated: 7/2/01
Sponsor's Authorized Representative

Cynthia Stewart, Airport Manager
Typed Name and Title of Sponsor's Representative

certcslt.doc

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SEA403247

SPONSOR CERTIFICATION FOR PROJECT PLANS AND SPECIFICATIONS

King County	King County International Airport	3-53-0058-26
Sponsor's Name	Airport	Project Number

Runway 13L-31R Rehabilitation
Project Description

Section 509(d) of the Airport and Airway Improvement Act of 1982, as amended (herein called the Act), authorizes the Secretary to require certification from sponsors that they will comply with statutory and administrative requirements. The following list of certified items includes major requirements for this aspect of project implementation. However, the list is not comprehensive, nor does it relieve sponsors from fully complying with all applicable statutory and administrative standards. Every certified item must be marked. Each certified item with a "no" response must be fully explained in an attachment to this certification. If the item is not applicable to this project, mark the item "N/A," General AIP standards are described in Advisory Circular 150/5100-6, 150/5100-15, and 150/5100-16. A list of current advisory circular with specific standards for design or construction of airports and procurement or installation of airport equipment and facilities is references in Grant Assurance 34.

1. The plans and specifications were developed in accordance with al applicable Federal standards and requirements, and no deviation from or modification to standards set forth in the advisory circular (was) (will be necessary other than those previously approved by FAA. *See Modifications to Standards listing.* Yes_x__No____N/A____

2. Specifications for the procurement of equipment are not proprietary or written so as to restrict competition. At least two manufacturers can meet the specification. Yes__x__No____N/A____

3. The development included in the plans is depicted on an airport layout plan approved by FAA. Yes__x__No____N/A____

4. Development which is ineligible for AIP funding has been omitted from the plans and specifications, or included on a separate bid schedule. Yes____No____N/A_x___

5. Process control and acceptance tests required for the project by standards contained in Advisory Circular 150/5370-10 are included in the project specifications. Yes__x__No____N/A____

6. If a value engineering clause is incorporated into the contract, concurrence was obtained from FAA. Yes__x__No____N/A____

7. The plans and specifications incorporate applicable requirements and recommendations set forth in Federally-approved environmental finding. Yes____No____N/A_x__

8. For construction activities within or near aircraft operational areas, the requirements contained in Advisory Circular 150/5370-2 have been discussed with FAA and incorporated into the specifications. A safety/phasing plan has been prepared, the FAA concurrence (has been) obtained, if required. *See Safety/Phasing Plan Sheet 15.* Yes__x__No____N/A____

9. The project will be physically completed without Federal participation in costs due to errors or omissions in the plans and specifications which were foreseeable at the time of project design. Yes_x___No____N/A____

I certify that, for the project identified herein, the responses to the foregoing items are correct as marked, and that the attachments, if any, are correct and complete.

Signed: Cynthia Stewart Dated: 7/2/01
Sponsor's Authorized Representative

Cynthia Stewart, Airport Manager
Typed Name and Title of Sponsor's Representative

June 18, 2001
File No. 23-00-009-002-01

DESIGN REPORT

KING COUNTY INTERNATIONAL AIRPORT
(BOEING FIELD)
RUNWAY 13L-31R REHABILITATION

AIP Project No. 3-53-0058-26

Project Description

The primary objective of King County International Airport's 2001 project is to complete the remaining elements of development necessary to bring the Airport's secondary Runway 13L-31R into total compliance with FAA requirements for a commercial service runway.

These areas of focus include the transverse grooving of the runway suface and the installation of distance-remaining signage and runway end identifier lights (REILs). Prior to grooving, the runway will receive and asphalt overlay averaging approximately 5" in depth. The grooving will allow for rapid dissipation of storm water from the pavement surface, thereby reducing the possibility of hydroplaning. Appropriate transitions from the edge of new runway pavement will be made into connecting taxiways and adjacent shoulder areas.

The distance-remaining signage will offer pilots an additional tool for identifying remaining usable pavement during take offs and landings. The REILs will assist pilots approaching the airport in identifying the position of the runway. The electrical vault will be upgraded as necessary to accommodate the runway's increased electrical demands.

Work to be included in this project is consistent with FAA design criteria, except as noted in this report

Project Layout

The primary portion of King County International Airport's project is situated within the immediate vicinity of the secondary Runway 13L-31R. Some electrical upgrading will be necessary at the electrical vault located near the base of control tower on the west side of the field. No construction associated with the project offers interference to Part 77 imaginary surfaces.

Soils Evaluation

An evaluation of existing soils immediately adjacent to Runway 13L-31R was conducted by PacRim Geotechnical Inc. of Seattle, Washington for purposes of identifying soil types and characteristics. Four exploratory pits were dug to depths of 8 to 11 feet, two at locations along the runway's west edge and two in the vicinity of the runway's east edge. This PacRim information was utilized for the subgrade analysis and was taken into consideration for the overlay design of the new pavement section. In order to be consistent with the philosphy behind the FAA's method of pavement design, the soil types provided by PacRim were factored into the pavement section design for this project. The PacRim report is attached.

Existing Pavement Testing / Evaluation

A non-destructive evaluation was performed by Pavement Engineers along the length of Runway 13L-31R. The runway pavement was found to be of reasonable uniformity in terms of strength along its length.

The new overlay averaging 5" will provide a healthy layer of asphalt to be grooved and will help smooth out the riding characteristics of the runway. Pavement strength must be considered within the runway's intersections with Taxiways A4, A7 and the future A3 because those taxiways provide cross-field access for the larger Boeing aircraft including 747-200, 757 and 767. The existing pavement section is not adequate to consistently carry this heavy loading and the approximate 18" of overlay necessary to bring these crossings up to full strength is not compatible with the new surface profile of the runway. The more practical solution is to remove the existing pavement within these intersections and construct the new pavement sections from the "bottom up;" In other words, the existing pavement is to be excavated to a depth that will allow for a new "deep" pavement section that has a surface grade compatible with the new runway profile.

Using a mix of projected heavy traffic over these areas as provided by King County International Airport and utilizing a subgrade CBR of 8 based on soil types information provided by PacRim a new full strength pavement section to be constructed within the Runway 13L-31R's intersections with Taxiways A4, A7 and the future A3 was determined according to the FAA program to consist of 4" Surface, 14.5" Base and 19" of Subbase. This initial designed section was modified to reflect 4" of P-401 Bituminous Surface Course, 16" of P-401 Bituminous Base Course, 6" of P-209 Crushed Base and approximately 24" of a quarry spall foundation material to insure that the subgrade that was subjected to significant movement during the recent earthquake is stabilized. The quarry spall foundations within these intersections are also designed to compensate for any moisture that may collect below the grade of the new subdrain system.

As a cross check, and based on their calculated subgrade CBR of 4, the pavement analysis conducted by Pavement Engineers was considered. This analysis recommended that an overlay of 16" to 18" would be required to reach targeted strength levels withing these taxiway intersections. A copy of the Pavement Engineers report is included with this design report.

The possibility of overlaying Runway 13L-31R with Portland Cement Concrete was not considered economically practical due to the 6 inch minimum FAA-required concrete depth

and the resulting need for longer transitions into connecting taxiways than are necessary with the shallower asphalt overlay. A concrete overlay was also not considered to be practical from a construction standpoint due to the extreme variation in required overlay depths. Quality pavement sections with highly variable depths are better accomodated by asphalt pavement construction.

Pavement Specifications

The primary reason for the King County International Airport Runway 13L-31R Rehabilitation is to provide a new pavement layer suitable for grooving.

This runway is utilized for departures and landings almost exclusively by aircraft weighing 12,500 # or less. Asphalt material specified for the project will be P-401 for weights in excess of 60,000 #, even though such loadings will typically be seen only within the intersections with Taxiways A4, A7 and the future A3. From a construction standpoint it is advantageous to minimize the number of materials used, and a single standard of P-401 will allow for continuous application of pavement from one runway end to the other. The use of the higher-standard P-401will necessitate higher density targets that are anticipated to be attainable within all areas of the runway.

Due to the Airport's location adjacent to Puget Sound, the potential for pavement damage due to frost action is considered negligible and was not included as a basis for pavement design.

Rehabilitation Limits and Surface Slopes

Runway 13L-31R will be rehabilitated along approximately 3,550' of its full 3,710' length. The extreme ends will not be overlayed due to impracticality of transitioning, in accordance with FAA grade criteria, a new pavement depth into the connecting Taxiways A2 and A8. Surface grooving, a primary objective of this project, will be done to within 10' of each runway threshold and to within 10' of each runway edge. The existing 100' width will be maintained with paved edge transitions consistent with existing asphalt shoulders in some portions of the runway and graded shoulders consistent with existing turfed shoulders in other runway areas (see attached 9/09/2000 justification for maintaining the existing 100' runway width).

The runway's new longitudinal surface grades will be consistent with the criteria of AC 150/5300-13 while matching as closely as practical with the existing centerline grade. The runway's new transverse grades will also be consistent with AC 150/5300-13 and will match to the greatest practical extent the existing cross slopes, although the existing surface slopes within the majority of the runway's area are flatter than current criteria. It should also be noted that during the earthquake of February 28, 2001, the runway was subjected to some severe differential settlement and, in some areas, a degree of upheave. As a result, the post-earthquake runway surface is further from conformance with FAA criteria, most obviously in terms of longitudinal grade. This project provides an opportunity to bring these non-standard grades into conformance with current criteria. Transverse grades will typically reflect a 1.25% centerline crown. Transitions into intersecting taxiways will be consistent with criteria while conforming as closely as practical with the existing surfaces.

Location of Future Taxiway A3

The location of the future Taxiway A3 has been indicated graphically on the most recent version of the Airport Layout Plan update with the new taxiway centerline placed approximately 250' north of the existing Taxiway A3. The new alignment connects into the main runway 13R-31L in the immediate vicinity of Taxiway B3, connecting the main runway with the parallel west-side Taxiway B. This alignment and location offers efficient east/west cross-field movement. The existing Taxiway A3 will be removed once the new Taxiway A3 is constructed.

The specific final location of the future Taxiway A3 will overlap the existing A3 alignment, with the north edges of both actually coinciding. In terms of angle of connection into the main runway, the taxiway will be a mirror image of Taxiway A4. This location slightly to the south of the position indicated on the ALP will provide direct taxiing between the east end of the new Taxiway A3 and the Terminal / ramp area, will provide for more wing clearance and allow easier movement for large aircraft taxiing between Taxiway A and the area currently occupied by the Terminal Building. It will also allow an aircraft landing from the south to exist the main runway at virtually the same location as is currently done with Taxiway A4.

Sub-Drain System

In order to meet FAA requirements for new or rehabilitated runway pavement structures and to offer protection against subsurface moisture , a subdrain system will be constructed adjacent to the runway's pavement edge. The system will consist of 6" perforated PVC pipe varying 20" to 30" deep in a drainrock filled trench wrapped with filter fabric. The new subdrain system will connect into the existing storm drain system that generally is routed through the infield areas and parallel to the runway.

Electrical and NAVAIDs

New REILs will be installed at each runway "corner" relative to the landing thresholds. Runway distance remaining signage will be installed as appropriate along one side of the runway. Existing runway edge lights will not be relocated laterally but will, in some cases, require vertical adjustment so that the fixtures are compatible with new runway shoulder elevations.

The existing runway edge lights will maintain their current locations but due to the fact that the runway overlay will also result in shoulders at somewhat higher elevations, most of the edge lights will need to be adjusted vertically.

The electrical vault will be modified to an extent that will allow the additions of the distance remaining signage and the REILs. It should be noted that the existing vault does not have capacity or room to physically accommodate any additional equipment. In fact, lack of clearance between vault hardware is currently in conflict with electrical code. It will be beneficial to the Airport to program at complete electrical vault replacement as a future project.

Bid Package

The Basic Bid for King County International Airport's 2001 construction project will consist of the rehabilitation of the existing secondary Runway 13L-31R including runway overlay, the addition of a pavement subdrain system, the vertical adjustment of existing edge lights, and the installation of lighted distance remaining signage and REILs.

Additive Bids will include the full depth reconstruction of Taxiways A4, A7 and the future Taxiway A3.

Safety / Phasing

As on any airport construction project, safety procedures are a major concern to all parties involved. Any construction within specified distances from active runway and taxiway surfaces will require the temporary closure of those areas to all except emergency operations. During these operations, construction equipment and personnel will be moved to FAA-specified distances from the operational surfaces. Careful and controlled routing of equipment will be observed throughout the project. All details related to safety issues are covered on the safety/phasing construction plan sheet.

Because of work to be performed along the full length of Runway 13L-31R, and the runway's intersection with active cross-field taxiways A4 and A7, a phasing and safety plan has been developed that addresses the appropriate sequencing of construction work.

An additive bid item for traffic control on the part of the contractor has been included in the specification proposal. The Airport intends to evaluate the bid price for this item against the cost of utilizing Airport staff to provide the traffic control.

Construction Schedule

The 75 calendar-day construction schedule is anticipated to begin in early August, 2001. The construction is targeted for substantial completion in October 2001.

Boeing Field
RW 13L-31R Rehab
June '01

FAA Project Manager
Minimum Plans & Specification Review Items

Preliminary:
Design Aircraft Mix — See report & pavement design calcs
Aircraft Approach Category
Airplane Design Group FAA Standards

Plans:

1. **Dimensional Standards -** **Fig 7-1 of AC 150/5300-4B**
   Fig 2-1, 3-1, & 4-1 of AC 150/530012
2. **Longitudinal & Transverse Grades of Runways & Taxiways**
3. **Transverse Grade of Safety Areas**
4. **Longitudinal Grade of Safety Area Beyond Runway Ends**
5. **Runway Line of Sight**
6. **Threshold Siting for Displaced of Relocated Thresholds** Threshold stripe correction
7. **Runway Lighting Layout & Fixture Height**
8. **Siting & Aiming Criteria for VASI's, PAPI's, or PLASI's**
9. **Siting Criteria for NAVAIDS, Approach Light Systems, & REILS**
10. **Presence of Ineligible Work** Earthquake (2/28/01) repair funding
11. **Nonstandard Items Identified in Engineer's Report**

Specifications:

1. **Presence of General Conditions & Federal Provisions**
2. **Special Provisions**
3. **Minority Business Enterprise (MBE) Goals**
4. **Safety & Security Plans or Equivalent Conditions Such as Shutdown of Operational Areas, Phasing of Work, etc.**
5. **Contract Award Provisions Including Alternatives**
6. **Nonstandard Items Identified in Engineer's Report**
7. **P-401:** **Bituminous Material Specified**
   Job Mix Formula Requirements
   Gradation
   Acceptance Sampling & Testing
8. **P-402:** **Bituminous Material Specified**
   Job Mix Formula Requirements
   Gradation
9. **P-501:** **Gradations**
   Portland Cement Type
   Admixtures
   Flexural Strength Specified
   Accepting Sampling & Testing
   Groove Width, Depth, & Spacing Specified

KCSlip4 36709

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FAA Project Manager
Desired Additional Plans & Specification Review Items

Preliminary: **Design Aircraft** Mix
Aircraft Approach Category BII Standards
Airplane Design Group

Plans:

✓ 1. **Marking Layout & Colors**

✓ 2. **Taxiway Lights - Color, Fixture Height, & Distance from Pavement Edge**

~~3.~~ **Obstructions to Approaches for New Runways or Runway Extensions**

~~4.~~ **Pavement Jointing Design**

~~5.~~ **Apron Tiedown Layout**

Specifications:

✓ 1. **Liquidated Damages**

✓ 2. **Contract Time**

✓ 3. **Application of Order 5100.38, Paragraph 807, Solicitations Containing Both Eligible & Ineligible Work**

✓ 4. **Security Requirements**

✓ 5. **Any Technical Specification Not covered by FAA Standard Specifications**

~~6.~~ **P-151:** **None**

✓ 7. **P-152:** **Compaction Requirements**

~~8.~~ **P-154:** **Gradation**
Compaction Requirements

~~9.~~ **P-155:** **Compaction**
Percent Lime

~~10.~~ **P-206:** **Gradation**

~~11.~~ **P-208:** **Gradation**
Compaction Requirements

✓ 12. **P-209:** **Gradation**
Compaction Requirements
Percent Fractured Faces
Percent Wear

~~13.~~ **P-210:** **Gradation**
Compaction Requirements

~~14.~~ **P-211:** **Gradation**
Compaction Requirements

~~15.~~ **P-212:** **Gradation**
Compaction Requirements

~~16.~~ **P-213:** **Gradation**
Compaction Requirements
Percent Sand

17. P-214: Gradation

18. P-215: Bituminous Material Specified
Gradation
Compaction Requirements
Density Method & Limits
Aggregate Quality Limits

19. P-216: Bituminous Material Specified
Gradation
Compaction Requirements
Density Method & Limits
Aggregate Quality Limits

20. P-217: Gradation
Compaction Requirements

21. P-301: Portland Cement Type
Portland Cement Quantity Limits

22. P-304: Portland Cement Type
Portland Cement Quantity Limits
Gradation
Compressive Strength Specified
Acceptance Testing Specified

23. P-306: Portland Cement Type
Portland Cement Quantity Limits
Gradation
Compressive Strength Specified
Acceptance Sampling & Testing

✓24. P-401: In Addition to Minimum Review Items
Aggregate Quality Tests

25. P-402: In Addition to Minimum Review Items
Aggregate Quality Tests
Job Mix Formula

26. P-501: In Addition to Minimum Review Items
Aggregate Quality Tests

27. P-602: Bituminous Material Specified
Application Rate

✓28. P-603: Bituminous Material Specified
Application Rate

✓29. P-605: Type Specified

30. P-606: None

31. P-609: Aggregate Quality Tests
Bituminous Material Application Rates
Aggregate Application Rates
Gradation
Bituminous Material Specified

✓32. P-610: None if Minor Contract Item
If Major, Review

✓33. P-620 Type of Paine
Application Rate

34. P-625: Gradation
Bituminous Material Specified
Composition of Mixture

35. P-626: Gradation
Aggregate Application Rate
Asphalt Application Rate
Bituminous Material Specified

36. F-160: None

37. F-161: None

38. F-162: Gauge and Mesh of Wire Specified

39. D-701: Backfill Compaction Requirements

40. D-705: None

41. D-751: None

42. D-752: None

43. D-754: None

44. T-901: None

45. T-903: None

46. T-904: None

47. T-905: None

48. T-907: None

49. T-908: None

50. L-101: None

51. L-102: None

52. L-103: None

53: L-107: None

54: L-108: Type of Cable Specified

55: L-109: None

56: L-110: None

57: L-112: None

58: L-119: None

59: L-125: None

Note: For electrical specifications, L-Series, check to see if each component of a system is present and the applicable equipment specifications (AC No.) are referenced.

6/18/01

MODIFICATIONS TO STANDARDS

King County International Airport (Boeing Field) - Runway 13L-31R Rehabilitation
AIP Project No. 3-53-0058-26

A-100	**FOD Prevention Controls**
Entire Section	**FOD Prevention Controls**
Modification:	Add Foreign Object Debris/Damage prevention control specification
Justification:	The specification provides information to the Contractor regarding the appropriate procedures to be followed in order to maintain debris-free active aircraft areas throughout the duration of the project.
D-701	**Pipe for Storm Drains and Culverts**
Section **701-2.2**	**High Density Polyethylene Pipe**
Modification:	Add specification for High Density Polyethylene Pipe
Justification:	The specification provides information to the Contractor regarding the material requirements for HDPE pipe.
D-705	**Pipe Underdrains for Airports**
Section **705-2.1**	**Perforated High Density Polyethylene Pipe**
Modification:	Add specification for Perforated High density Polyethylene Pipe
Justification:	The specification provides information to the Contractor regarding the material requirements for Perforated HDPE pipe.
D-705	**Pipe Underdrains for Airports**
Section **705-2.2**	**Filter Fabric**
Modification:	Add specification for Filter Fabric
Justification:	The specification provides information to the Contractor regarding the filter fabric to be used to enclose the runway's subdrain trench.

D-709	**Quarry Spalls**
Entire Section	**Quarry Spalls**
Modification:	Add Quarry Spall specification
Justification:	The specification provides information to the Contractor regarding the materials requirements and placement of the quarry spalls as foundation stabilization within the reconstructed runway intersections with Taxiways A4, A7 and the future A3.
D-751	**Manholes, Catch Basins, Inlets and Inspection Holes**
Section **751-3.9**	**Catch Basin / Manhole Adjustments**
Modification:	Add specification for Catch Basin and Manhole adjustments
Justification:	The specification provides information to the Contractor regarding the adjustments of catch basins and manholes to grades compatible with new pavement surfaces..
L-100	**Electrical General Requirements**
Entire Section	**Electrical General Requirements**
Modification:	Add general requirements for electrical work
Justification:	The specification provides information to the Contractor regarding electrical work specified elsewhere , applicable codes, existing conditions and maintaining of service.
L-105	**Airfield Lighting**
Entire Section	**Airfield Lighting**
Modification:	Add section for installation of airfield lighting
Justification:	The specification provides information to the Contractor regarding the materials and installation of the new Runway 13L-31R REILs and vertically adjusted existing edge lights.

L-107	**Signs**
Entire Section	**Signs**
Modification:	Add specification for materials, installation and adjustments of runway signs.
Justification:	The specification provides information to the Contractor regarding the materials and installation of the new lighted signs and vertical adjustments to existing signs.

L-110	**Underground Electrical Duct**
Section 110-4.1f	**Trench and Backfill (Turf and Infield)**
Modification:	Add specification for trench and backfill within infields and all non-paved areas
Justification:	The specification provides information to the Contractor regarding the work and materials to be included under this trench and backfill item.

L-110	**Underground Electrical Duct**
Section 110-4.1g	**Trench and Backfill (Pavement)**
Modification:	Add specification for trench and backfill within existing pavement limits on this project.
Justification:	The specification provides information to the Contractor regarding the work and materials to be included under this trench and backfill item.

L-110	**Underground Electrical Duct**
Section 110-4.1i	**Patching**
Modification:	Add specification for pavement patching
Justification:	The specification provides information to the Contractor regarding the work and materials to be included for the patching of existing pavement.

L-110 **Underground Electrical Duct**

Section **110-4.1j** **Sawcutting**

Modification: Add specification for pavement sawcutting
Justification: The specification provides information to the Contractor regarding the work to be included under the sawcutting of existing pavement for electrical trenches .

P-150 **Mobilization**

Section **150-1.2** **Utility Locate**

Modification: Add specification for Utility Locate
Justification: The specification provides information to the Contractor regarding the locating and tracking responsibilities for existing underground utilities during construction.

P-150 **Mobilization**

Section **150-1.3** **Construction Survey**

Modification: Add specification for Construction Survey
Justification: The specification provides information to the Contractor regarding the extent of his survey responsibility during construction.

P-150 **Mobilization**

Section **150-1.4** **Traffic Control**

Modification: Add specification for Traffic Control
Justification: The specification provides information to the Contractor regarding the equipment and training procedures required during construction.

P-152	**Excavation and Embankment**
Section **152-2.10**	**Imported Borrow**
Modification:	Add specification for Imported Borrow
Justification:	The specification provides information to the Contractor regarding the appropriate material to be used in conjunction with runway/taxiway shoulder transitions.
Section **152-2.11**	**Grading**
Modification:	Add specification for Grading.
Justification:	The specification provides information to the Contractor regarding required grading within shoulders and safety areas.
Section **152-2.12**	**Sawcutting of Existing Asphalt**
Modification:	Add specification for Sawcutting of Existing Asphalt.
Justification:	The specification provides information to the Contractor regarding the sawcutting of Asphalt along trench lines and at limits of pavement reconstruction.
Section **152-2.13**	**Pavement Removal**
Modification:	Add specification for Pavement Removal.
Justification:	The specification provides information to the Contractor regarding the removal of existing pavement within designated locations.
P-156	**Temporary Air and Water Pollution, Soil Erosion and Siltation Control**
Entire Section	**Temporary Air and Water Pollution, Soil Erosion and Siltation Control**
Modification:	Add specification for Temporary Air and Water Pollution, Soil Erosion and Siltation Control
Justification:	Specifically, the specification provides information to the Contractor regarding the work and materials to be included under hydroseeding.

P-157 **Pavement Grinding**

Entire Section **Pavement Grinding**

Modification: Add specification for Pavement Grinding
Justification: The specification provides information to the Contractor regarding the extent and depth of pavement grinding and method of grindings disposal.

P-401 **Plant Mix Bituminous Pavements**

Section **401-3.2** **Job Mix Formula**
Table 3
Modification: Substitute original P-401 gradation (Surface Course and Base Course) specification with that of WSDOT Class B.
Justification: The substitution applies to the aggregate gradation only. The substitution will allow the contractors to utilize sieves with which they are more accustomed and still yield an asphalt mix of equal quality to true P-401.

Section **401-4.4 (cc)** **Bituminous Pavers / Survey**

Modification: Add survey control specification.
Justification: The specification provides information to the Contractor regarding the typical survey grid to be utilized in conjunction with the pavement section lifts.

Section **401-5.1 b(1)** **Mat Core Density**

Modification: Asphalt core for mat density determination is to be taken by sponsor's representative.
Justification: Since the mat core density for payment evaluation purposes is to be determined by the sponsor's quality assurance laboratory, the core will also be cut by the sponsor's rep, not the contractor. By doing so, the sponsor's lab can certify that the core was taken from the correct area.

Section **401-5.1 b(2)** **Joint Density**

Modification: Asphalt core for joint density determination is to be taken by sponsor's representative.
Justification: Since the joint core density for payment evaluation purposes is to be determined by the sponsor's quality assurance laboratory, the core will also be cut by the sponsor's rep, not the contractor. By doing so, the sponsor's lab can certify that the core was taken from the correct area.

Section **401-5.1 b(3)** **Sampling**

Modification: Clarification that holes left in pavement following coring operation are to be filled by the contractor.

Justification: The specification eliminates a common misunderstanding in field regarding responsibility for filling holes.

P-700 **Crack Grouting**

Entire Section **Crack Grouting**

Modification: Add Crack Grouting specification

Justification: The specification provides information to the Contractor regarding the materials and methods for repair of wide cracks within existing pavement.

P-800 **Trench Excavation Safety Provisions**

Entire Section **Trench Excavation Safety Provisions**

Modification: Add Trench Excavation Safety Provisions specification

Justification: The specification addresses safety measures to be taken by the Contractor when constructing trenches exceeding a depth of 4'.

6/20/01

DATE SPONSOR'S REPRESENTATIVE

DATE APPROVED BY (FAA)

KCSlip4 36719

SEA403264

Reid Middleton

6/21/01

KING COUNTY INTERNATIONAL AIRPORT - BOEING FIELD

OPINION OF PROBABLE COST
RUNWAY 13L-31R REHABILITATION

	Construction	Quantity	Unit Price	Cost
	Basic Bid Schedule A Runway 13L/31R Rehabilitation			
1	LS Mobilization	1	$100,000	$100,000
2	LS Utility Locate	1	$5,000	$5,000
3	LS Construction Survey	1	$40,000	$40,000
4	LS FOD Control	1	$100,000	$100,000
5	LS Trench Excavation Safety Provisions	1	$5,000	$5,000
6	Ac Hydroseeding	2	$3,000	$6,000
7	SY Chip Seal Grinding & Disposal	37,500	$1.50	$56,250
8	SY Asphalt Pavemnt Grinding & Disposal	8,000	$12	$96,000
9	SY Concrete Pavement Grinding & Disposal	4,000	$15	$60,000
10	CY Borrow Material	665	$12	$7,980
11	LF 6" Perf. Rigid HDPE Pipe	5,400	$20	$108,000
12	LF 6" Rigid HDPE Pipe	360	$25	$9,000
13	EA Type 1 Catch Basin	24	$1,000	$24,000
14	Ea MH / CB / EB Vertical Adjustments	20	$500	$10,000
15	LF Crack Seal	3,000	$0.5	$1,500
16	Tn Bituminous Tack Coat (CSS-1)	30	$300	$9,000
17	Tn Bituminous Surface Course	11,500	$40	$460,000
18	SF Runway and Taxiway Painting	89,500	$0.40	$35,800
19	SY Asphalt Pavement Grooving	29,800	$2	$59,600
			Subtotal	$1,193,130

	Construction	Quantity	Unit Price	Cost
	Basic Bid Schedule B - Electrical			
1 EA	REILs	2	$9,317.50	$18,635
2 EA	Hand Holes	23	$915.92	$21,066
3 LF	One 3" PVC Conduit	290	$13.22	$3,834
4 LF	Two 3" PVC Conduit	3,450	$13.22	$45,609
5 LF	2" PVC Conduit	130	$7.83	$1,018
6 LF	2 Way 3" Encased PVC Conduit	160	$39.99	$6,398
7 LF	3 Way 3" Encased PVC Conduit	690	$59.00	$40,710
8 LF	4 way 3" Encased PVC Conduit	230	$77.28	$17,774
9 LF	#12 600 V Conductor	29,710	$0.52	$15,449
10 LF	#10 600 V Conductor	16,590	$0.60	$9,954
11 LF	#6 600 V Conductor (Deleted)			$0
12 LF	Trench & Backfill (Turf & Infield)	4,090	$10.72	$43,845
13 LF	Trench & Backfill (Pavement)	730	$15.77	$11,512
14 LF	#12 Ground Conductor	5,550	$0.52	$2,886
15 EA	New Lighted Signs Size 5	2	$1,951.00	$3,902
16 EA	Existing Sign - Vertical Adjustment	10	$480.40	$4,804
17 EA	Ext RW/TW Base Cans in Pvmt 1/8" to 1"	1	$192.00	$192
18 EA	Ext RW/TW Base Cans in Pvmt 1" to 1-5/8"	6	$203.17	$1,219
19 EA	Ext RW/TW Base Cans in Pvmt 1-5/8" & Over	22	$227.36	$5,002
20 EA	Ext RW/TW Base Cans in Soil 1/8" to 1"	2	$129.00	$258
21 EA	Ext RW/TW Base Cans in Soil 1" to 1-5/8"	1	$140.00	$140
22 EA	Ext RW/TW Base Cans in Soil 1-5/8" & Over	4	$164.25	$657
23 SF	Patching	1,050	$4.00	$4,200
24 LF	Sawcutting	1,500	$5.00	$7,500
			Subtotal	$266,565

	Construction	Quantity	Unit Price	Cost
	Basic Bid Schedule C - Earthquake Repair Funding			
1 LF	Sawcutting	280	$5	$1,400
2 SY	Asphalt Pavement Removal	160	$12	$1,920
3 LS	Pipe & CB Removal & Disposal	1	$500	$500
4 LF	12" Class V Concrete Pipe	212	$30	$6,360
5 LF	Crack Grouting	400	$7	$2,800
6 SY	Reinforcing Fabric	100	$2	$200
7 Tn	Bituminous Surface Course	5,300	$40	$212,000
			Subtotal	$221,360

	Construction	Quantity	Unit Price	Cost
	Additive Bid Schedule A			
1 LS	Traffic Control	1	$100,000	$100,000

	Construction	Quantity	Unit Price	Cost
	Additive Bid Schedule B Taxiway A-7 Crossing			
1	LF Sawcutting	650	$5	$3,250
2	SY Asphalt Pavement Removal & Disposal	2,400	$12	$28,800
3	SY Concrete Pavement Removal & Disposal	1,000	$20	$20,000
4	CY Excavation	2,400	$10	$24,000
5	Tn Quarry Spalls	1,500	$18	$27,000
6	CY Base Course	400	$25	$10,000
7	Tn Bituminous Base Course	2,250	$40	$90,000
8	Tn Bituminous Surface Course	560	$40	$22,400
9	Tn Bituminous Tack Coat (CSS-1)	6	$300	$1,800
			Subtotal	$227,250

	Construction	Quantity	Unit Price	Cost
	Additive Bid Schedule C Taxiway A-4 Crossing			
1	LF Sawcutting	650	$5	$3,250
2	SY Asphalt Pavement Removal & Disposal	2,400	$12	$28,800
3	SY Concrete Pavement Removal & Disposal	1,000	$20	$20,000
4	CY Excavation	2,400	$10	$24,000
5	Tn Quarry Spalls	1,500	$18	$27,000
6	CY Base Course	400	$25	$10,000
7	Tn Bituminous Base Course	2,250	$40	$90,000
8	Tn Bituminous Surface Course	560	$40	$22,400
9	Tn Bituminous Tack Coat (CSS-1)	6	$300	$1,800
			Subtotal	$227,250

	Construction	Quantity	Unit Price	Cost
	Additive Bid Schedule D Taxiway A-3 Crossing			
1	LF Sawcutting	650	$5	$3,250
2	SY Asphalt Pavement Removal & Disposal	2,400	$12	$28,800
3	SY Concrete Pavement Removal & Disposal	1,000	$20	$20,000
4	CY Excavation	2,400	$10	$24,000
5	Tn Quarry Spalls	1,500	$18	$27,000
6	CY Base Course	400	$25	$10,000
7	Tn Bituminous Base Course	2,250	$40	$90,000
	Tn Bituminous Surface Course	560	$40	$22,400
	Tn Bituminous Tack Coat (CSS-1)	6	$300	$1,800
			Subtotal	$227,250
			Total	$2,462,805
			8.8% Tax	$216,726.81
			Construction Total	$2,679,532

AIRPORT PAVEMENT DESIGN

STATE	CITY	AIRPORT
Washington	Seattle	King County International Airport
PROJECT NUMBER	**SPONSOR**	**DESIGN ENGINEER**
3-53-0058-26	King County	Reid Middleton

PROJECT DESCRIPTION The primary objectives of the pavement rehabilitation for Boeing Field's Runway 13L-31R include the asphalt overlay of the existing pavement surface *(information provided below)* and the transverse grooving of the new asphalt surface. If funding is available, the runway's intersections with Taxiways A4, A7 and the future A3 will be reconstructed to accomodate east-west field crossings for heavier aircraft.

GROSS ALLOWABLE AIRCRAFT WEIGHT (KIPS)

(Gear configuration or aircraft type)

SINGLE WHEEL	DUAL WHEEL	DUAL TANDEM	B-747	L-1011	CD-10
12.500					

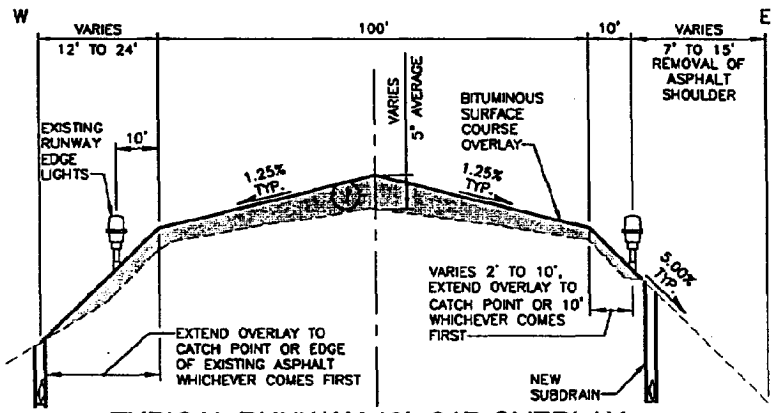
DESIGN CRITERIA

DESIGN A/C	EQUIV. DEPARTURES	CBR	K	GR. A/C WT.	USC	FLX. STRENGTH	Cb or Cr	F
		8						

TYPICAL SECTIONS

(Show and number each course)

NON-CRITICAL AREAS	CRITICAL AREAS



TYPICAL RUNWAY 13L-31R OVERLAY
ON EXISTING VARIABLE PAVEMENT SECTION

DESIGN DETAILS

NO.	COURSE	THICKNESS OF PAVEMENT						SPECIFICATION
		RUNWAY	NON-CRIT RUNWAY	TAXIWAY	NON-CRIT TAXIWAY	APRON		
1	Bit. Surface	5" (average)						P-401

FAA FORM 5100-1 (7-80)

KCSlip4 36723

SEA403268

AIRPORT PAVEMENT DESIGN

STATE	CITY	AIRPORT
Washington	Seattle	King County International Airport
PROJECT NUMBER	**SPONSOR**	**DESIGN ENGINEER**
3-53-0058-26	King County	Reid Middleton

PROJECT DESCRIPTION The primary objectives of the pavement rehabilitation for Boeing Field's Runway 13L-31R include the asphalt overlay of the existing pavement surface and the transverse grooving of the new asphalt surface. If funding is available, the runway's intersections with Taxiways A4, A7 and the future A3 will be reconstructed to accomodate east-west field crossings for heavier aircraft *(information provided below)*.

GROSS ALLOWABLE AIRCRAFT WEIGHT (KIPS)

(Gear configuration or aircraft type)

SINGLE WHEEL	DUAL WHEEL	DUAL TANDEM	B-747	L-1011	CD-10
		400,000 (Equiv.)			

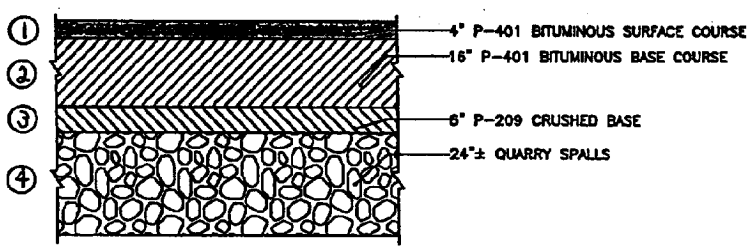
DESIGN CRITERIA

DESIGN A/C	EQUIV. DEPARTURES	CBR	K	GR. A/C WT.	USC	FLX. STRENGTH	Cb or Cr	F
757 (Equiv.)	2,559	8						

TYPICAL SECTIONS

(Show and number each course)

NON-CRITICAL AREAS	CRITICAL AREAS



TYPICAL RUNWAY 13L-31R INTERSECTION RECONSTRUCTION
@ TAXIWAYS A4, A7 & (FUTURE) A3

DESIGN DETAILS

NO.	COURSE	THICKNESS OF PAVEMENT						SPECIFICATION
		RUNWAY	NON-CRIT RUNWAY	TAXIWAY	NON-CRIT TAXIWAY	APRON		
1	Bit. Surface	4"						P-401
2	Bit. Base	16"						P-401
3	Cr. Base	6"						P-209
4	Quarry Spall	24" +/-						D-709

FAA FORM 5100-1 (7-80)

KCSlip4 36724

SEA403269

SOIL ANALYSIS

TEST HOLE	DEPTH OF SAMPLE	GRADATION (% PASSING) 3"	2"	1"	3/4"	1/2"	3/8"	4	10	40	100	200	% FINER[1] THAN .02 MM	L.L.	P.I.	USC

See Pac Lim Report

SUBGRADE CHARACTERISTICS

AVERAGE FROST PENETRATION	SUBSURFACE DRAINAGE	FROST DESIGN METHOD[2] CP	LSP	RSP	RSS	NONE

COMMENTS[3]

NOTES:
1. Applies only when material is used above frost line.
2. Select one.
3. Attach sketch showing location of borings.

SUBMITTED BY	TITLE	DATE
APPROVED BY	FAA REGIONAL PAVING ENGINEER	DATE
APPROVED BY	FAA STATE AIRPORT ENGINEER	DATE

KCSlip4 36725

SEA403270

Mar '81

FLEXIBLE PAVEMENT DESIGN PROGRAM
(F 8 0 6 F A A)
DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
WASHINGTON, D.C.

REFERENCES: ADVISORY CIRCULAR 150/5320-6

boe2.doc

DESIGN PARAMETERS
DESIGN FOR MIXED AIRCRAFT

< 1 >	SUBGRADE FROST CODE	= F - *
< 2 >	SUBGRADE CBR	= 8.0
< 3 >	NUMBER OF SUBBASES	= 1
< 4 >	SUBBASE (1) FROST CODE	= F - 0
< 5 >	SUBBASE (1) CBR	= 20.0
< 6 >	BASE TYPE	= P-209
< 14 >	DEGREE DAYS	= .00
< 15 >	DRY DENSITY(#/CU. FT.)	= .00

FOR	DESIGN LOAD	DESIGN DEPARTURES	EQUIV. ANNUAL DEPARTURES
BOEING 757	400000.	720.	720.
BOEING 767	400000.	720.	720.
BOEING 747	780000.	720.	1119.

CONTROLLING AIRCRAFT

FOR BOEING 757 DESIGN LOAD = 400000.
DESIGN ANNUAL DEPARTURES = 2559.

TRAF AREA	SURFACE THICKNESS (INCHES)	BASE THICKNESS (INCHES)	SUBBASE (3)	(2)	THICKNESS (1) (INCHES)
CRITICAL	4.0	14.5			19.0
NONCRIT	3.0	13.0			17.1
EDGE	2.8	10.1			24.6

ADDITIONAL NOTE: VALUES IN ( ) ARE SUBMINIMAL COMPUTED THICKNESSES.

KCSlip4 36726

SEA403271

3/01/01

Boeing Field - Runway 13L-31R Rehab
Intersections With Taxiways A3, A4 & A7
Pavement Section Conversion

1" AC = 1.0" AC
1" AC = 1.5" Crushed Rock
1" AC = 2.0" Gravel

* Per F806FAA Program

for CBR = 8

Designed Pavement Section:	* Required Pavement Section:	Excess Material	Excess Equiv. AC	Additional Required Material	Additional Required Equiv. AC	Additional Required AC
20.00 " AC Depth	4.00 " AC Depth	16.00	16.00	0.00	0.00	-16.00
6.00 " Crushed Rock Depth	14.50 " Crushed Rock Depth	0.00	0.00	8.50	5.67	5.67
0.00 " Gravel Depth	19.00 " Gravel Depth	0.00	0.00	19.00	9.50	9.50

** Total Additional AC" Required -0.83

** Minimum strength requirement is met
Quarry spall "subbase" will add further strength

KCSlip4 36727

Ac-convr.xls

SEA403272

King County
International Airport/Boeing Field
Cynthia Stewart, Manager
Department of
Construction and Facility Management
MS ACF-CF-0100
7233 Airport Way South
P.O. 80245
Seattle, WA 98108
(206) 296-7380
(206) 296-0190 FAX
(206) 296-0100 TDD
Web site: http://www.metrokc.gov/airport

November 9, 2000

Karen Miles
SEA-ADO
Federal Aviation Administration
1601 Lind Avenue
Renton, Washington 98055

Dear Ms. Miles:

This letter is in response to your request that the King County International Airport (KCIA) justify maintaining the existing 100' width of Runway 13L-31R as opposed to reconfiguring to a 60' width that would typically be applicable for a B-1 Small category. The 100' width can be justified on the basis of additional expense for full width paving versus the cost of repositioning the runway's electrical system to a 60' runway width.

A recent engineering estimate provided by KCIA's consultant, Reid Middleton, indicates that it would be more costly to reposition the runway edge lighting and associated systems than the additional cost to pave the full existing 100' runway width (assuming a 3" average overlay depth). Based on this most recent comparison, a savings of approximately $35,000 can be realized if the runway maintains its current 100' wide configuration. Detailed cost breakdowns and a basic sketch are included with this letter but the costs can be summarized as follows:

• Cost of repositioning existing edge lighting system (60' width)	$227,000
• Cost associated with paving beyond a 60' width (full 100')	$192,000
Difference	$ 35,000

We would also like to offer the following observations and assumptions:

- According to records, the existing Runway 13L-31R pavement has not received any significant upgrading since a chip seal application in 1969. Considering its age, the pavement is in fairly good condition with only a minimal amount of cracking and no obvious rutting.
- The length of paved transitions and associated asphalt tonnage into connecting taxiways is assumed to be essentially the same whether the paved "full strength" runway width is 60' or 100'.
- The existing edge lighting and associated electrical system are at least 10 years old and present no reoccurring maintenance problems. However, if the system is repositioned, it would be prudent to replace all below-ground hardware and cable in order to avoid premature failures of the adjusted system. The above-ground fixtures are assumed to be healthy and reusable in the new positions.
- Electrical trenching for the 60' width would be routed in a direct line with the new edge light positions. This trenching would be through existing pavement and would require pavement patching.

Given the factors discussed above, we propose that Runway 13L-31R's existing configuration be rehabilitated including paving and grooving.

If you have further questions, please contact John Current, Program Planning Manager, at (206) 205-8357.

Thank you for your assistance with this matter.

Sincerely,

Cynthia Stewart

Cynthia Stewart
Airport Manager

cc: John Current, Program Planning Manager

KCSlip4 36729

SEA403274

Budget Estimate

ELCON ASSOCIATES, INC.
ENGINEERS - CONSULTANTS

All amounts Rounded

Project Name: King County Airport
Project Number: 5667-018.00
Facility: 60' and 75' R/W Width--New Lighting System
Division 16 - Electrical

Prepared By: GCS
Checked By:
Revision #:
Date: 7/21/00

	Description	QTY	Unit	Unit Cost $	Total Cost $
1	Sawcut 5"-6" Asphalt	15,360	LF	$1.50	$23,040
2	Asphalt Disposal (Off Site)	1,280	SYD	$15.00	$19,200
3	Trench and Backfill (18"W X 24"D) Incl. Compaction	7,680	LF	$1.22	$9,370
4	Patch Trench	1,280	SYD	$50.00	$64,000
5	Base Cans	52	EA	$150.00	$7,800
6	Relocate Lights	52	EA	$125.00	$6,500
7	Conduit 2" PVC	7,800	LF	$4.64	$36,190
8	Conductor #6, 5kV	8,000	LF	$2.67	$21,360
9	Relocate and Reconnect Signs	11	EA	$1,750.00	$19,250
10					
11					
12					
13					
14					
15					
16					
17					
18					
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32					
33					
34					
35					

This estimate assumes:
1. VASI Not Relocated
2. Only Hold Signs Relocated
3. Declared Distances Lighting May Add Fixtures

SUB TOTAL: $206,710
Contingency 10% : $20,670
TOTAL: **$227,380**

KCSlip4 36730

SEA403275

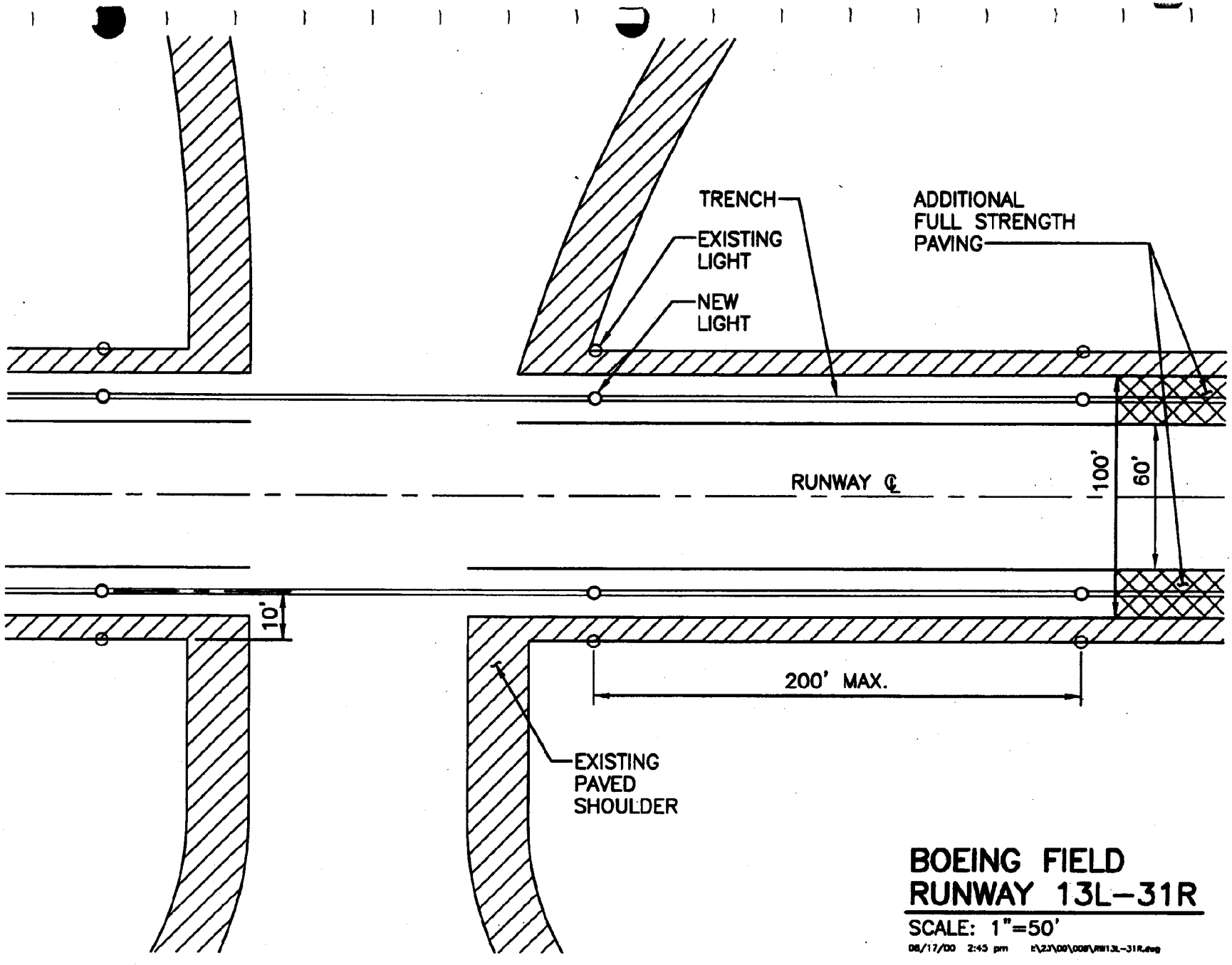
ReidMiddleton

8/09/00

BOEING FIELD -- RUNWAY 13L-31R UPGRADING

PRELIMINARY PROJECT COST ESTIMATE
Additional Paving-Related Costs for 100' vs. 60' Runway Width

	Construction	Quantity	Unit Price	Cost	
SY	Asphalt Pavement Grinding	16,500	$1.25	$20,600	
CY	Off-Site Disposal of Pavement Grindings	600	$10	$6,000	
Tn	Bituminous Tack Coat (CSS-1)	10	$300	$3,000	
Tn	Bituminous Surface Course (3" ave.)	2,800	$40	$112,000	
SY	Pavement Grooving	16,400	$2	$33,000	
			Total	$174,600	
			10% Contingencies	$17,400	
			Construction Total		$192,000



BOEING FIELD
RUNWAY 13L–31R

SCALE: 1"=50'

08/17/00 2:45 pm I:\2J\00\008\R13L-31R.dwg

KCSlip4 36732

SEA403277

Boeing Field

Pavement Evaluation

Runway 13L-31R and Cross Taxiways

Prepared for

Reid Middleton and Associates

February 8, 2001

PAVEMENT ENGINEERS

15226 12th Drive S.E
Mill Creek, WA 98012-3082
(425) 337-5222

PAVEMENT ENGINEERS

WBE# W2F4707915

15226 12th Drive S.E
Mill Creek, WA 98012-3082
(425) 337-5222
(888) 446-5222
(425) 337-6084 FAX
website: pvmtengr.com

February 8, 2001

Randy Hall
Reid Middleton
728 134th Street SW, Suite 200
Everett, WA 98204

Re: Pavement Evaluation – Runway 13L-31R and Cross Taxiways
Boeing Field

Dear Randy:

This letter report discusses our testing and evaluation of the Runway 13L-31R at Boeing Field. The purpose of this evaluation is to determine the existing strength of Runway 13L-31R and the cross taxiways and to provide recommendations on their rehabilitation and upgrade.

Non-Destructive Deflection Testing

Our testing consisted of non-destructive deflection testing using the KUAB Falling Weight Deflectometer which can impact the pavement surface with loads from 5,000 to 12,000 pounds. These loads are intended to simulate aircraft loading.

Tests were located at 200 foot intervals on both sides of centerline in order to obtain sufficient test points for analysis. Surface deflections were recorded at four locations out from the center of the impact load: 0", 12", 24", and 36". This set of four deflections provides a deflection basin that will be used later in our analysis. A total of 45 tests were be taken.

Figure 1 presents the deflection profile taken along the runway. In order to reduce the clutter in the figure, only the 0" and 36" deflections are plotted.

Pavement Structure

FAA Form 5320-1, Appendix B, was available for pavement structure information and indicated the asphalt pavement was 6" along the southern half of the runway and 5" along the northern half. A spreadsheet named PVTMAINT.XLS dated 4/3/96, Appendix B, indicates the pavement has three distinct pavement sections. The southern half of the runway (Taxiway A8 to Taxiway A4) has two pavement sections split closely along the centerline. One the west side of centerline the pavement section is 2-5" ACP plus 9" PCC plus 6" Crushed Aggregate. One the east side of centerline the spreadsheet indicates a 6-8" ACP surface with no indication of aggregate base. For the northern half (Taxiway A4 to Taxiway A2) the spreadsheet indicates a 5-8" ACP surface with no indication of aggregate base.

Three cores taken approximately 6 feet east of centerline with the following results.

1. Station 9+00 - 8 ¾" ACP/no bond/ 5" ACP/ gravel base.
2. Station 16+00 - 4" ACP/ weak bond/ 5 ¾" ACP/ weak bond/ 4" ACP
3. Station 25+00 – 9 ¾" ACP (in four distinct lifts, very good bond)

Analysis

The deflections and the pavement structure information was used to calculate the resilient modulus of the pavement layers and subgrade. Normally the thickness of each pavement layer is fixed and the resilient modulus is allowed to vary until the calculated deflections match those recorded in the field. However, because of the variability in the thickness of the asphalt layer along the project, a nominal modulus of 450,000 psi at 70° F. was selected for the asphalt and the thickness was allowed to vary. Although this approach takes longer to merge to a solution, it did provide a better description of the conditions in the field.

Since a simplified three layered system (Surface, Base, Subgrade) is used to represent a highly complex and variable pavement structure, some inaccuracies are expected. Allowing the thicknesses of the asphalt layer to vary in order to match the deflections in the field is an attempt to represent the variation in asphalt thicknesses normally encountered. As a result, the back-calculated modulus values and *Equivalent Thickness* of the pavement surface may be higher or lower than what actually exists. Changing soil conditions such as moisture content or density can also cause a dramatic effect on the back-calculated strength of the base and subgrade layers. The underlying 9" PCC pavement along portions of the runway, which typically has a resilient modulus of 4-8,000,000 psi can raise the normal modulus of the asphalt layer above and make it appear thicker than measured. Finally, fatigue cracking of the underlying asphalt layers may significantly reduce the *Equivalent Thickness* of the asphalt layer. With this in mind, the calculated modulus and thickness values should be looked at as a group rather than specific locations.

Figure 2 displays the modulus profiles calculated along the runway.

Figure 3 is the profile of the calculated *Equivalent Thicknesses*. The three cores are also plotted in this figure. The *Equivalent Thicknesses* seem to vary considerably, which is expected based on the age of the asphalt surface. Cracking and hardening of the asphalt due to age and oxidation can significantly reduce the measured thickness.

Pavement Capacity

The first step in developing the existing pavement capacity is to determine the design subgrade strength. FAA Circular 150/1530-6D recommends a value *one standard deviation below the mean* which we have selected to be approximately 4,000 psi.

This resilient modulus value was then converted to CBR values that is used in the FAA design manual using the following equation.

$$CBR = M_R / 1000$$

Where:

CBR - California Bearing Ratio, %
M_R - Resilient Modulus, psi

The devisor of 1,000 can be adjusted from 700 to 1,500 depending on the type of material. For this airport, the subgrade is classified as an E4 soil which is a fine, sandy soil of inferior

grading. We have found the above M_R - CBR relationship to be reasonable for this type of soil.

The CBR values determined from our testing are considerably less than that listed in the FAA Form 5320-1, Pavement Strength Survey (Appendix B) and the Spreadsheet dated 4/3/96 (Appendix B). Offsetting this drop in subgrade strength is the increased measured thickness of the pavement from that listed in the form. It is also worth noting that the pavement capacity shown on the 4/3/96 spreadsheet (previously mentioned) indicates a value of only 35,000 pounds SW.

Table 2. Pavement Structure Differences

Design Section Spreadsheet dated 4/3/96 Designation	Pavement Structure	
	This Analysis	Spreadsheet
SR1	4" AC 9" PCC Subgrade kValue=50	2-5" AC 9" PCC Subgrade K=300
SR2	13" AC Subgrade CBR=4	6-8" AC Subgrade CBR=15
SR3	13" AC Subgrade CBR=4	4-7" AC Subgrade CBR=15
SR4		4-7" AC 9" PCC Subgrade K=300
SR5	9 ¾" AC 6" Crushed Base Subgrade CBR=4	5-8" AC 6" Crushed Base Subgrade CBR=15

Our calculations and interpretation of FAA Advisory Circular 150/5320/6D indicates the following pavement strength values.

Table 3. Pavement Strength, x 1,000 pounds

Design Section	FAA 5320-1 Designation	CBR Value	This Analysis		FAA Form 5320-1 dated 5/11/89		Spreadsheet dated 4/3/96	
			SW	DW	SW	DW	SW	DW
Runway 13L-31R (southern half)	R6	4	30	<50	70	120	35	60
Runway 13L-31R (northern half)	R7	4	30	<50	35	60	35	60

SW - Single Wheel
DW - Dual Wheel
DT - Dual Tandem
< - Below the design curve
<< - Considerably below the design curve

Conclusions and Recommendations

The runway is in good condition except for some stripping of the seal coat. This stripping is not confined to the aircraft wheel path but, rather is scattered across the entire runway surface in a blotchy fashion. Continued stripping of this seal coat does not seem to be a problem and does not warrant removal before an overlay is applied. However, in order to provide a consistent textured surface, the existing seal coat could be removed by grinding. The grinding will also provide a rough-textured interface that will reduce slippage along this interface from breaking aircraft.

The Spreadsheet dated 4/3/96 indicates the current design aircraft loads for the runway is 20,000# single wheel. Our modification of the pavement strength does not restrict the current design aircraft.

A 2 – 3 inch asphalt overlay should be adequate to handle current traffic.

Cross Taxiway Capacities

We were asked to evaluate the cross taxiways, A4, A5, and A7 to handle heavy aircraft as follows.

Table 4. Aircraft Loading at Cross Taxiways

Aircraft	Operations	
	Round trips per day	Annual Crossings
747-200	2	1,460
757	5	3,650
767	5	3,650

The FAA computer program *LedFAA* was used to determine the overlay and new pavement section needed to handle the traffic listed in Table 4. A printout of these calculations is provided in Appendix C. These calculations indicate an 18" asphalt overlay on Taxiway A4 and a 16" asphalt overlay on Taxiways A5 and A7.

A new PCC pavement section was calculated for the taxiways in order to reduce the overlay requirements along the runway. This pavement section is 18" PCC plus 6" Crushed Aggregate, P-2[illegible].

Pavement Engineers, Inc.

DIDRIK A. VOSS STATE OF WASHINGTON 12759 REGISTERED PROFESSIONAL ENGINEER EXPIRES 7/28/2002

Didrik A. Voss, P.E.
Chief Engineer
P559

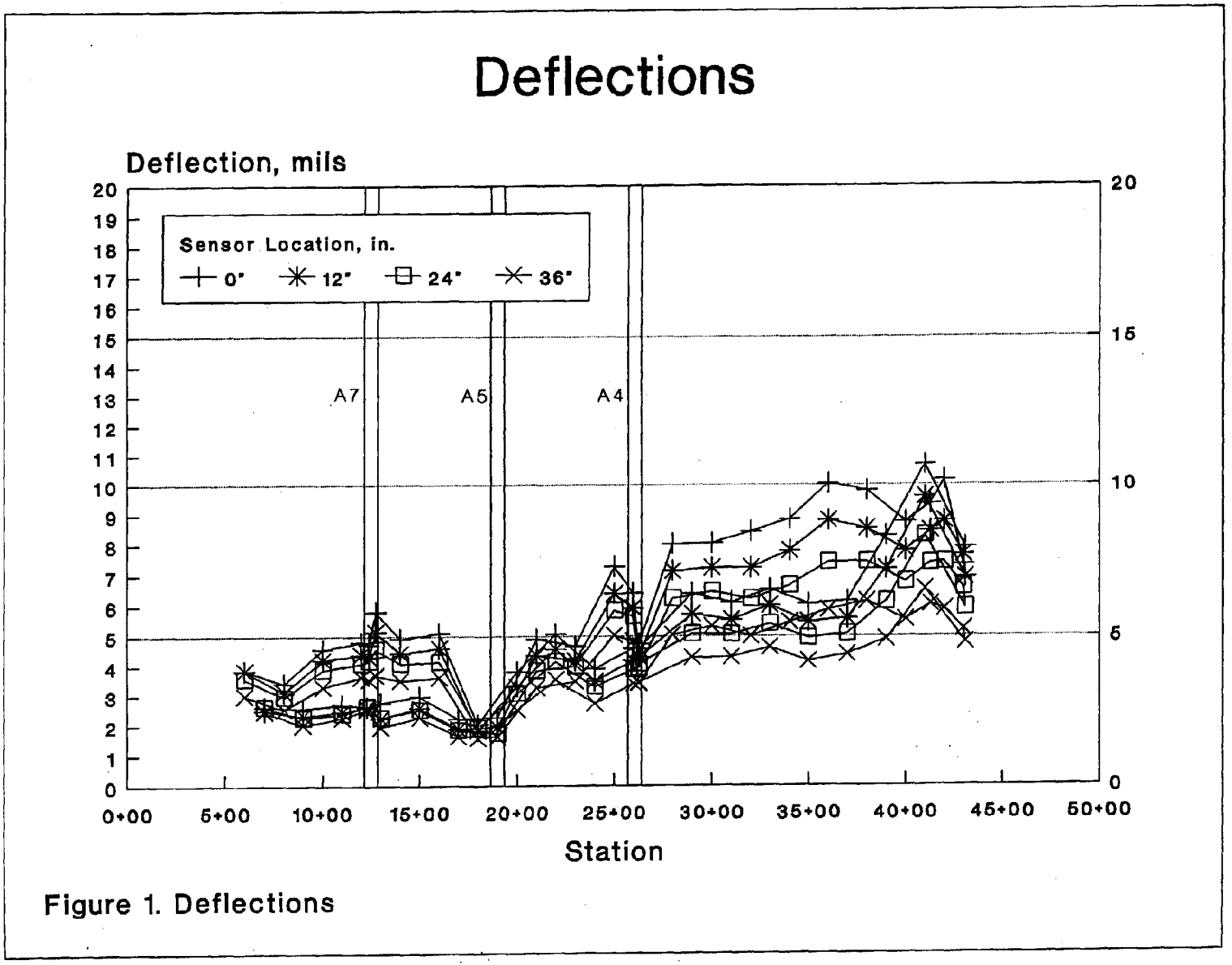


Figure 1. Deflections

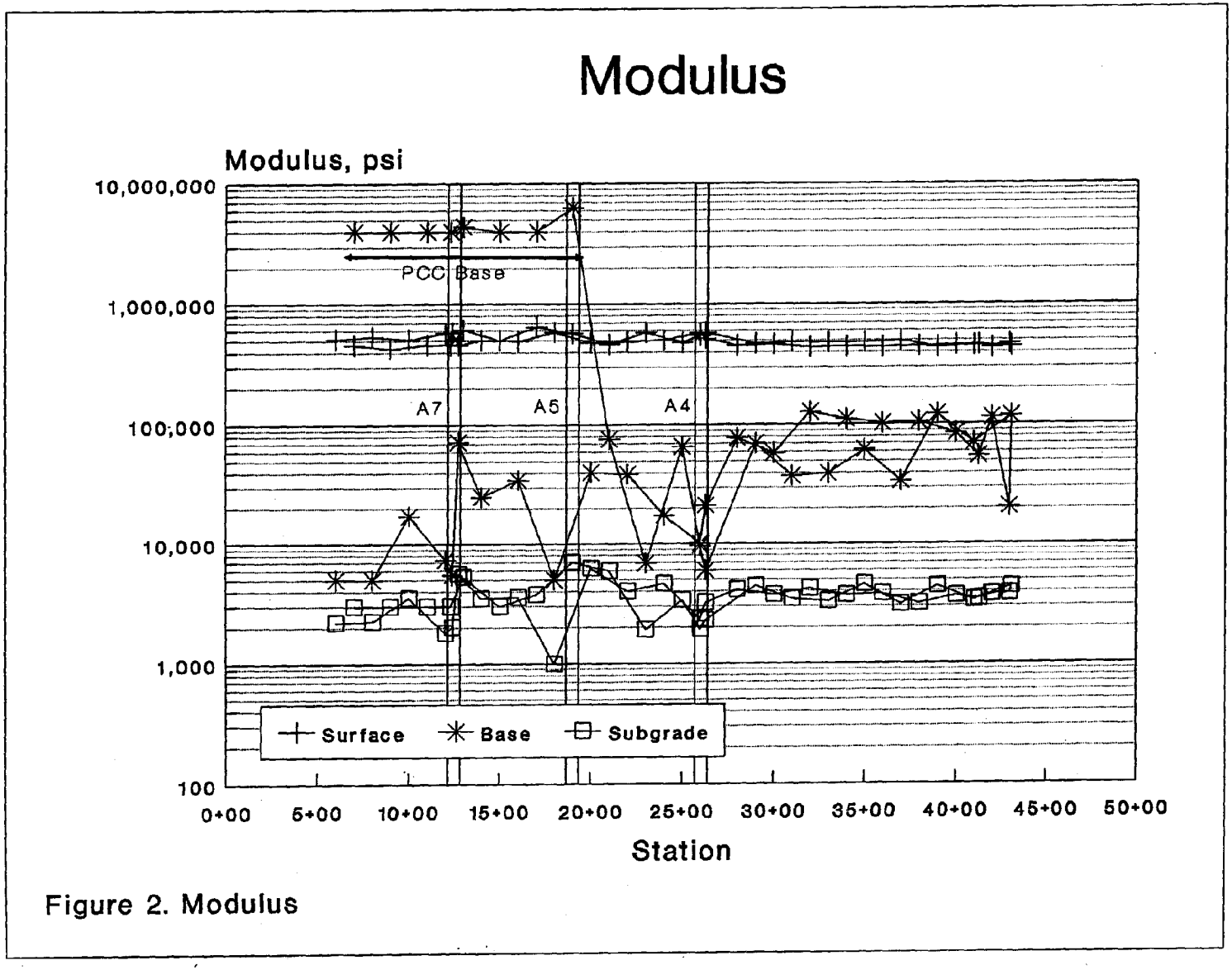


Figure 2. Modulus

Appendix A

```
IKUAB FWD FILE     : BOEING1
HAgency            : Boeing Field
HProject Number    :
HRoad Name         : Shrt Rnwy
HTest Section      : 1
HDirection         : 1
HStart Point       : edge f pvmt
H  End Point       :
HLane Number       :
HOperator          : D. A. Voss
H                  :
HSurface Type      : acp
HPoisson Ratio     :
HWeather           : overcast
HComment           : 10 ft off cntrln

IDate Created      : 07-01-2001
ILoad Mode         : 1          (2 + 2 buffers)
IPlate Radius      : 5.91       (in)
IExtra Field Set   : KUAB STANDARD
IDrop Sequence     : 1123
INo of drops       : 1111
IRecord Drop?      : NYYY
IDrop Height       :     1     2     3     4
IImpact Load       :  5000  9000 12500     0 lbf
ISensor Number     :     0     1     2     3     4     5     6
ISensor Distance   :  0.00 11.81 17.72 23.62 35.43 47.24 82.68 (i
n)
ISensor Position   : CENTER BEHIND BEHIND BEHIND BEHIND ?????? ??????

IReference Offset :   1000 ft
ITestpoint spacing:    200 ft
```

J	Distance ft	Imp Num	Load lbf	D0 mils	D1 mils	D2 mils	D3 mils	D4 mils	Air øF	E Mod Mpa
D	600	2	5438	2.54	2.38	2.36	2.39	1.99	50	1216
D	600	3	9496	4.07	4.06	3.95	3.78	3.17	50	1326
D	600	4	12700	5.44	5.32	5.17	4.87	4.07	50	1327
c	Comment at 598 ft :yellow hash area									
D	801	2	5211	2.16	1.91	1.81	1.84	1.65	51	1371
D	801	3	9358	3.57	3.25	3.04	3.08	2.65	51	1492
D	801	4	12611	4.68	4.24	4.04	3.90	3.51	51	1534
c	Comment at 801 ft :10 ft off cntrln									
D	1000	2	5225	2.85	2.55	2.41	2.29	2.06	52	1044
D	1000	3	9368	4.76	4.37	4.11	4.04	3.43	52	1120
D	1000	4	12618	6.23	5.67	5.37	5.14	4.55	52	1151
D	1199	2	5214	2.85	2.69	2.53	2.47	2.18	51	1041
D	1199	3	9328	4.98	4.55	4.35	4.23	3.76	51	1064
D	1199	4	12585	6.59	5.99	5.75	5.47	4.94	51	1086

```
c  Comment at 1203 ft :edge of A7

D    1239   2  5226   2.80   2.57   2.44   2.41   2.12    51   1063
D    1239   3  9389   4.93   4.49   4.32   4.35   3.69    51   1082
D    1239   4 12665   6.62   5.97   5.67   5.45   4.87    51   1088
c  Comment at 1241 ft :15 ft of cntrln of A7

D    1273   2  5179   3.30   2.95   2.64   2.53   2.08    52    891
D    1273   3  9267   5.99   5.30   4.86   4.70   3.80    52    879
D    1273   4 12546   8.12   7.26   6.74   6.36   5.24    52    878
c  Comment at 1275 ft :15 ft off cntln A7

D    1400   2  5167   2.97   2.69   2.56   2.52   2.18    52    988
D    1400   3  9249   5.06   4.55   4.29   4.20   3.61    52   1040
D    1400   4 12515   6.80   6.08   5.69   5.43   4.64    52   1047
c  Comment at 1400 ft :sta 10+00 is stop bar

D    1601   2  5154   3.05   2.77   2.64   2.32   2.13    52    961
D    1601   3  9242   5.24   4.72   4.44   4.26   3.72    52   1004
D    1601   4 12497   6.80   6.28   5.92   5.94   5.01    52   1046
D    1800   2  5154   1.19   1.08   1.04   1.22   0.88    52   2453
D    1800   3  9254   2.10   1.87   1.80   1.97   1.61    52   2506
D    1800   4 12539   2.68   2.44   2.37   2.21   2.08    52   2658
c  Comment at 1800 ft :100 ft to A5

D    2001   2  5117   2.24   2.06   1.87   1.92   1.62    52   1301
D    2001   3  9222   3.90   3.40   3.18   3.16   2.59    52   1346
D    2001   4 12523   5.19   4.51   4.25   4.02   3.45    52   1373
c  Comment at 2001 ft :chip seal 1/8 - 1/4 inch is stipping along some
snivies
D    2200   2  5057   3.15   2.83   2.65   2.31   1.97    54    912
D    2200   3  9201   5.19   4.66   4.41   4.23   3.63    54   1009
D    2200   4 12490   7.05   6.19   5.90   5.80   5.01    54   1007
D    2399   2  5093   2.29   2.09   1.96   1.91   1.66    54   1266
D    2399   3  9200   4.00   3.57   3.40   3.38   2.79    54   1309
D    2399   4 12464   5.60   5.02   4.65   4.55   3.88    54   1267
D    2598   2  5129   2.41   2.25   2.10   2.35   1.82    55   1208
D    2598   3  9218   4.70   4.29   4.05   3.98   3.49    55   1114
D    2598   4 12557   6.36   5.87   5.58   5.28   4.72    55   1122
c  Comment at 2598 ft :15 ft off cntrln A4

D    2627   2  5114   2.80   2.64   2.47   2.49   2.12    55   1040
D    2627   3  9260   4.88   4.43   4.18   4.04   3.53    55   1079
D    2627   4 12558   6.49   5.88   5.58   5.47   4.68    55   1100
c  Comment at 2627 ft :15 ft off A4 cntrln

D    2799   2  5044   4.65   4.29   3.89   3.69   3.04    54    616
D    2799   3  9137   8.14   7.25   6.73   6.33   5.12    54    638
D    2799   4 12437  10.86   9.57   8.93   8.24   6.79    54    651
D    3001   2  5051   4.47   4.19   3.89   3.83   3.10    54    642
D    3001   3  9186   8.22   7.39   6.93   6.59   5.44    54    635
D    3001   4 12480  10.91   9.76   9.10   8.54   7.16    54    650
```

D	3200	2	5051	4.60	4.22	3.83	3.69	2.90	54	624
D	3200	3	9165	8.57	7.37	6.75	6.33	5.09	54	608
D	3200	4	12473	11.47	9.94	9.16	8.39	6.77	54	618
D	3401	2	5019	4.96	4.51	4.13	3.89	3.21	54	576
D	3401	3	9111	8.95	7.89	7.23	6.74	5.53	54	579
D	3401	4	12413	11.91	10.53	9.66	8.93	7.37	54	593
c	Comment at 3401 ft :a lot of stripping of chip seal									
D	3600	2	5044	5.64	5.06	4.55	4.19	3.41	54	508
D	3600	3	9121	10.19	8.92	8.07	7.53	5.95	54	509
D	3600	4	12421	13.72	11.88	10.81	9.85	7.91	54	515
D	3799	2	5015	5.69	5.00	4.59	4.10	3.46	54	501
D	3799	3	9087	9.89	8.61	7.93	7.51	6.21	54	522
D	3799	4	12378	13.03	11.29	10.23	9.67	7.86	54	540
D	4000	2	5033	5.03	4.49	4.17	3.89	3.24	54	569
D	4000	3	9140	8.90	7.92	7.29	6.89	5.63	54	584
D	4000	4	12481	11.91	10.50	9.79	9.07	7.53	54	596
D	4129	2	5033	5.47	4.92	4.49	4.33	3.53	54	524
D	4129	3	9098	9.46	8.55	7.96	7.48	6.12	54	547
D	4129	4	12462	12.72	11.45	10.64	9.86	8.08	54	557
c	Comment at 4129 ft :stop bar at survey nail									
D	4201	2	5033	5.77	5.04	4.52	4.25	3.34	55	496
D	4201	3	9069	10.24	8.86	8.06	7.48	5.94	55	503
D	4201	4	12391	13.72	11.86	10.75	9.82	7.92	55	514
D	4299	2	5033	5.03	4.51	4.05	3.66	2.95	55	569
D	4299	3	9092	7.41	7.74	7.01	6.65	5.28	55	698
D	4299	4	12469	10.65	10.32	9.30	8.70	6.92	55	665
D	4308	2	5033	4.40	3.97	3.63	3.44	2.79	54	651
D	4308	3	9082	7.97	6.97	6.41	5.97	4.83	54	648
D	4308	4	12419	10.55	9.28	8.55	7.82	6.44	54	669
D	4100	2	4978	6.02	5.38	4.91	4.66	3.70	53	470
D	4100	3	9090	10.80	9.70	8.85	8.39	6.61	53	479
D	4100	4	12382	14.33	12.91	11.88	10.92	8.82	53	491
D	3899	2	4997	4.73	4.11	3.75	3.47	2.82	53	601
D	3899	3	9070	8.35	7.26	6.63	6.18	4.94	53	618
D	3899	4	12436	11.29	9.70	8.87	8.15	6.52	53	626
D	3700	2	5015	3.61	3.39	3.17	3.12	2.69	52	790
D	3700	3	9152	6.25	5.67	5.38	5.17	4.46	52	833
D	3700	4	12515	8.30	7.59	7.20	6.78	5.90	52	857
D	3499	2	4992	3.48	3.27	2.99	3.05	2.45	53	815
D	3499	3	9087	6.12	5.53	5.22	4.99	4.20	53	844
D	3499	4	12446	8.23	7.42	6.96	6.53	5.64	53	860
D	3300	2	4985	3.79	3.44	3.22	3.09	2.73	53	748
D	3300	3	9087	6.60	6.07	5.70	5.46	4.66	53	783
D	3300	4	12461	8.87	7.99	7.54	7.08	6.07	53	799
D	3101	2	4986	3.53	3.39	3.10	3.09	2.67	52	802
D	3101	3	9094	6.17	5.59	5.26	5.11	4.33	52	838
D	3101	4	12444	8.35	7.50	7.02	6.57	5.74	52	847
D	2900	2	4996	3.58	3.33	3.10	3.01	2.52	53	793
D	2900	3	9033	6.42	5.75	5.38	5.09	4.30	53	800
D	2900	4	12450	8.61	7.70	7.20	6.74	5.76	53	822

D	2627	2	5068	2.75	2.45	2.32	2.29	1.99	54	1050
D	2627	3	9148	4.68	4.37	4.18	4.14	3.52	54	1112
D	2627	4	12552	6.54	5.91	5.61	5.43	4.74	54	1091
c	Comment at 2627 ft :15 ft off A4 cntrln									
D	2596	2	5035	3.79	3.44	3.31	3.12	2.69	53	756
D	2596	3	9084	6.48	5.99	5.72	5.70	4.88	53	798
D	2596	4	12507	8.41	7.68	7.37	7.25	6.21	53	846
c	Comment at 2596 ft :15 ft off A4 cntrln									
D	2500	2	4976	4.30	3.73	3.53	3.21	2.76	53	659
D	2500	3	9087	7.36	6.47	5.98	5.91	5.08	53	702
D	2500	4	12480	9.66	8.61	8.03	7.62	6.39	53	735
D	2299	2	4936	2.80	2.43	2.39	2.31	2.00	54	1004
D	2299	3	9055	4.70	4.20	4.05	4.02	3.50	54	1094
D	2299	4	12472	5.98	5.49	5.11	5.14	4.47	54	1186
D	2100	2	4939	2.85	2.58	2.36	2.31	1.93	53	986
D	2100	3	9039	4.93	4.37	4.07	3.87	3.28	53	1042
D	2100	4	12461	6.74	5.99	5.58	5.20	4.41	53	1051
D	1899	2	4943	1.50	1.33	1.30	1.16	0.97	54	1874
D	1899	3	9042	2.28	1.96	1.89	1.74	1.62	54	2258
D	1899	4	12497	2.94	2.50	2.37	2.35	2.11	54	2419
D	1700	2	4974	1.25	1.18	1.10	1.16	1.07	54	2271
D	1700	3	9094	2.23	1.90	1.77	1.86	1.65	54	2323
D	1700	4	12539	2.86	2.46	2.37	2.41	2.14	54	2492
D	1501	2	4938	1.68	1.48	1.41	1.48	1.33	53	1674
D	1501	3	9056	3.01	2.63	2.52	2.54	2.29	53	1711
D	1501	4	12442	3.86	3.43	3.30	3.22	3.00	53	1834
D	1300	2	4974	1.60	1.36	1.27	1.34	1.18	52	1766
D	1300	3	9036	2.78	2.25	2.17	2.28	1.96	52	1847
D	1300	4	12453	3.81	3.08	2.95	2.87	2.65	52	1860
c	Comment at 1302 ft :in A7									
D	1230	2	4936	1.80	1.61	1.70	1.63	1.56	53	1555
D	1230	3	9043	2.66	2.63	2.58	2.66	2.55	53	1936
D	1230	4	12443	3.73	3.64	3.55	3.52	3.52	53	1897
c	Comment at 1230 ft :A7									
D	1101	2	4906	1.47	1.42	1.38	1.46	1.33	53	1892
D	1101	3	9056	2.73	2.48	2.38	2.40	2.27	53	1885
D	1101	4	12435	3.73	3.43	3.33	3.35	3.08	53	1896
D	899	2	4961	1.42	1.36	1.30	1.39	1.27	53	1981
D	899	3	9096	2.61	2.37	2.26	2.28	2.04	53	1985
D	899	4	12485	3.55	3.12	3.01	2.92	2.71	53	1999
D	700	2	4961	1.63	1.48	1.40	1.52	1.45	53	1734
D	700	3	9100	2.66	2.53	2.52	2.66	2.50	53	1948
D	700	4	12550	3.47	3.29	3.17	3.47	3.26	53	2054

BSurf Thick, in. : 0

Appendix B

KCSlip4 36745

L DFAA - Layered Elastic Airport Pavement Design (V 1.2)

S-ction AConFlex in Job BOEINGFL.

The structure is AC Overlay on Flexible. Asphalt CDF = 0.0001.
Design Life = 20 years.
A design for this section was completed on 02/08/01 at 11:53:31.

Pavement Structure Information by Layer, Top First

o.	Type	Thickness inches	Modulus psi	Poisson's Ratio	Strength R, psi
1	P-401 AC Overlay	18.00	200,000	0.35	0
2	P-401 AC Surface	13.00	200,000	0.35	0
3	P-209 Cr Ag	12.00	29,185	0.35	0
4	Subgrade	0.00	6,000	0.35	0

Total thickness to the top of the subgrade = 43.00 inches

Aircraft Information

No.	Name	Gross Wt. lbs	Annual Departures	% Annual Growth
1	B-767-300ER	345,000	1,825	0.00
2	B-757	250,000	1,825	0.00
3	B-747-200	833,000	730	0.00
4	B-777-200 A	537,000	1	0.00

NOTES

his is Taxiway A4

Mr raised to 6,000 psi so CBR is 4.0 (i.e. Mr = 1,500 CBR).
ince Mr was found to be 4,000 and I use Mr = 1,000 CBR.

LEDFAA - Layered Elastic Airport Pavement Design (V 1.2)

Section AConRigid in Job BOEINGFL.

The structure is AC Overlay on Rigid.
Design Life = 20 years.
A design for this section was completed on 02/08/01 at 13:19:08.

Pavement Structure Information by Layer, Top First

No.	Type	Thickness inches	Modulus psi	Poisson's Ratio	Strength R, psi
1	P-401 AC Overlay	20.00	200,000	0.35	0
2	PCC Surface	9.00	4,000,000	0.15	650
3	P-209 Cr Ag	6.00	13,200	0.35	0
4	Subgrade	0.00	4,000	0.40	0

Total thickness to the top of the subgrade = 35.00 inches

Aircraft Information

No.	Name	Gross Wt. lbs	Annual Departures	% Annual Growth
1	B-767-300ER	345,000	1,825	0.00
2	B-757	250,000	1,825	0.00
3	B-747-200	833,000	730	0.00
4	B-777-200 A	537,000	1	0.00

NOTES

AConRigid

This is crossing taxiways A7 and A5

Existing AC overlay is approximately 4" thick.

LEDFAA - Layered Elastic Airport Pavement Design (V 1.2)

Section NewRigid in Job BOEINGFL.

The structure is New Rigid.
Design Life = 20 years.
A design for this section was completed on 02/08/01 at 11:30:22.

Pavement Structure Information by Layer, Top First

No.	Type	Thickness inches	Modulus psi	Poisson's Ratio	Strength R, psi
1	PCC Surface	17.98	4,000,000	0.15	700
2	P-209 Cr Ag	6.00	13,200	0.35	0
3	Subgrade	0.00	4,000	0.40	0

Total thickness to the top of the subgrade = 23.98 inches

Aircraft Information

No.	Name	Gross Wt. lbs	Annual Departures	% Annual Growth
1	B-767-300ER	345,000	1,825	0.00
2	B-757	250,000	1,825	0.00
3	B-747-200	833,000	730	0.00
4	B-777-200 A	537,000	1	0.00

NOTES

NewRigid
Remove existing PCC and place new PCC

Appendix C

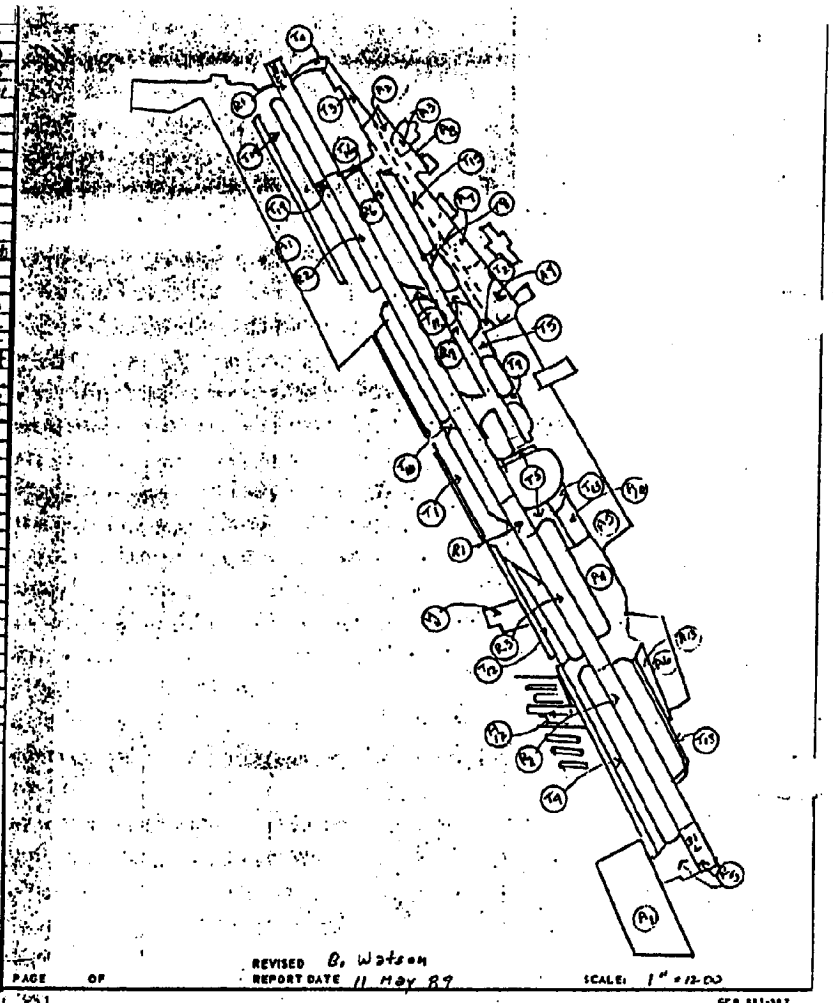
R2	E-4	Ra	6"		10" PCC	4½" AC		160'	340
R3	E-4	Ra	6"	0	8" PCC	1"+5" AC		170'	390
R4	E-4	Ra	6"	1	9" PCC	4"+4" AC		175'	395
R5	E-4	Ra	6"	1	11" PCC	4"+5" AC		200'	400+
R6	E-4	F1	0	6	6" AC	0	70	120'	
R7	E-4	F1	0	2	5" AC	0	35	60'	
				TAXIWAYS					
T1	E-4	F1	0	6"	6" PCC	9+4 AC		200'	400+
T2	E-4	Fa	0	9"	4" AC	4" AC (MIRO)		200'	400+
T3	E-4	F1	0	15"	4" AC			180'	260
T4	E-4	Ra	6	1	12 PCC			145'	300
T5	E-4	Ra	0	6	9 PCC		60	115'	180
T7	E-4	F2	8	7" ATB	4 AC		160	200'	350
T8	E-4	F1	0	2	2 AC		110		
T9	E-4	F2	6	6" ATB	4 AC			200	380
T10	E-4	F1	8	6" ATB	4 AC		160	200'	350
T11	E-4	F1	6 PVT	6" AC	4 AC		200	200	400
T12	E-3	F1	6	10" AC	4 AC			200'	400'
T13	E-4	F1	0	12	3 AC	3 AC		200'	335
T14	E-4	F1	0	6	6 PCC	9+4 AC		200'	400+
T15	E-4	F2	0	7	4 AC		45	80'	
T16	E-4	F2	0	6	2 AC		25	45'	
T17	E-4	F2	0	6	4 AC			40'	
T18	E-4	F2	0	6	4 AC			70	
				APRONS					
A1	E-4	Ra	6	0	16" PCC		160	200'	400+
A2	E-4	Fa		0	6" AC		25	45'	
A3	E-4	Fa		9"	4 AC	2" AC		160	330
A4	E-4	Ra		6"	9 PCC		60	85'	180
A5	E-4	Ra		6"	9 PCC		60	85'	180
A6	E-4	F1		6"	3 AC	3" AC			
A7	E-4	F1		10"	9 AC	4" AC	75	200'	400
A8	E-3	F2		5"	3 AC		33	100'	
A9	E-4	F1		6" ATB	4 AC	4" AC		200	400
A 10	E-4	F1		4	4 AC			60	
A 11	E-4	F1		5½"	3 AC		22	40'	
A 12	E-4	F1	4	4"	2½ AC		30	40	
A 13	E-4	F1		4"	3 AC		33	44	

REMARKS: Updated per information provided by Jeff Winston, Boeing field 5/1/89.

DATE ON SITE INSPECTION

INSPECTED BY: Jeff Winston

FAA Form 5320-1 (8-70)



REVISED B. Watson

REPORT DATE 11 May 89

SCALE: 1" = 12.00

PAGE OF

KCSlip4 36750

SEA403295

PAVEMENT STRENGTH SURVEY

IDENT.	SOIL CLASS.	SUBGR. CLASS	SUBBASE COURSE	BASE COURSE	SURFACE COURSE	OVERLAY	PAVEMENT STRENGTH MAX. GROSS LOAD SINGLE	DUAL	DUAL TAN.
RUNWAYS									
TAXIWAYS									
T-19						3-4"	75K	150K	250K
T-20	EA	EA		6"	2½" P401		24K		
T-21	EA	EA		10"	1½" P-HPCC		70K	170K	325K
T-22						6"-P-401			
APRONS									
A-14	EA	F1		6"	2" 401		24K		
A-15	EA	F1		2½"	3-6.5 AC	3-4" P401	45K	100	100
A-16	EA	F1		6" PCC	5" AC	6-8 P401	75K	200	350
A-17	EA	F1		10"	3" AC	4-6 P401	75	200	350
A-18	EA	F1		6" P401	4" P401	1-4 P401	75	200	350

REMARKS

DATE OF SITE INSPECTION

INSPECTED BY

PAGE OF

REVISED REPORT DATE

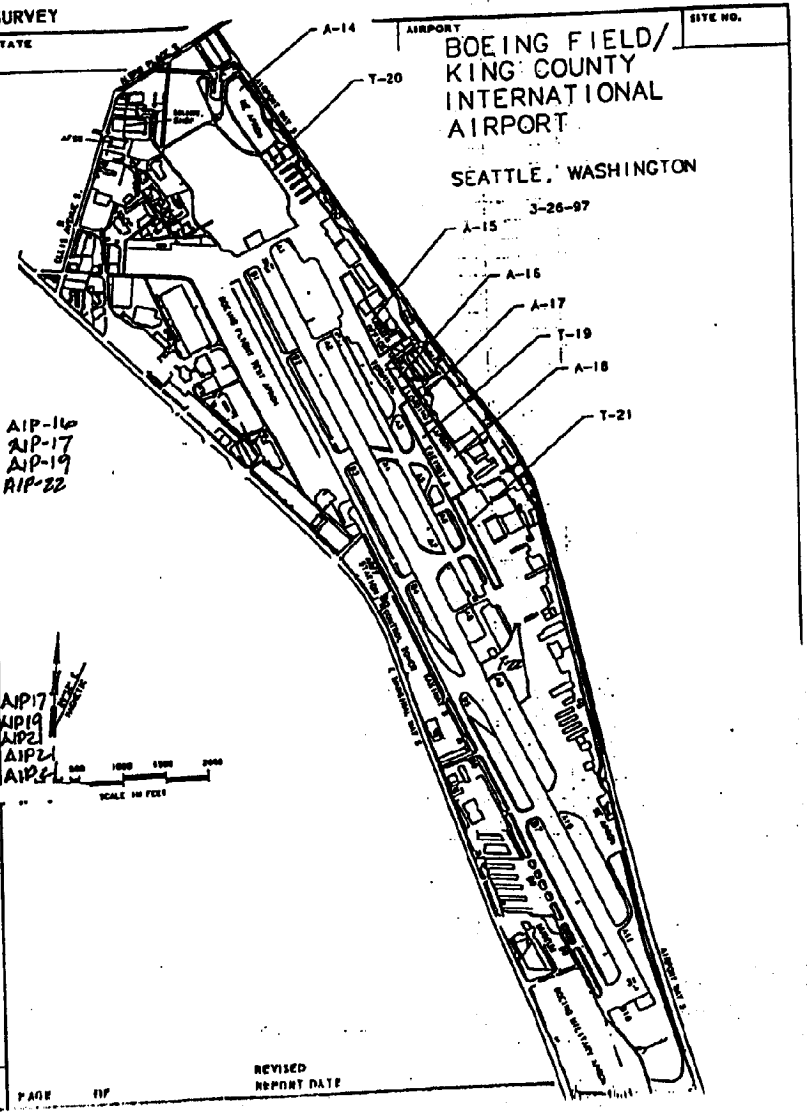
STATE

AIRPORT: BOEING FIELD/ KING COUNTY INTERNATIONAL AIRPORT

SEATTLE, WASHINGTON

SITE NO.

3-26-97



KCSlip4 36751

SEA403296

APPENDIX 2
FILE:PVTMAINT.XLS

AIRCRAFT PAVEMENT INVENTORY
KING COUNTY INTERNATIONAL AIRPORT

4/3/96
JEFF WINTER

PAV'T I.D.		LOCATION	DATE BUILT	DATE REHAB	AVEMENT SECTION (IN) AC	PCC	ATB	C. BASE	S-BASE	EQ.PCC	EXIST. STRENGTH (1000#) S	D	DT	SOIL CLASS	AIRCRAFT CLASS	DESIGN LOAD (1000#) S	D	DT	PAV'T. COND. INDEX PCI	DATE	STRENGTH INDEX
R	1	13R-31L	1952	1985	9-11	11		1	6	16	75	200+	400+	K=300	H	75	175	350	90	3/27/96	100
R	2	13R-31L	1952	1985	7-9	9		1	6	13	75	160	300	K=300	H	75	175	350	90	3/27/96	86
R	3	13R-31L	1958	1985	7-9	8		6	18	12	75	145	280	K=350	H	75	175	350	90	3/27/96	80
R	4	13R-31L	1958	1985	10-12	20		13	18	25.5	75	200+	400+	K=350	H	75	175	350	90	3/27/96	100
R	5	13R-31L	1958	1985	11-13	12		7		18	75	200+	400+	K=300	H	75	175	350	90	3/27/96	100
R	6	13R-31L	1954	1985	2.5-4.5	10		1	10.5	11.8	75	135	260	K=325	H	75	175	350	90	3/27/96	74
R	7	13R-31L	1954	1985	4-6	10		1	6	12.5	75	145	280	K=300	H	75	175	350	90	3/27/96	80
R	8	13R-31L	1954	1985	3-5			6	6		75	200+	370	CBR=15	H	75	175	350	90	3/27/96	106
R	9	13R-31L	1953	1985	3-5	10		1	10.5	12	75	140	270	K=325	H	75	175	350	90	3/27/96	77
R	10	13R-31L	1953	1985	3-5	10		1	6	12	75	130	260	K=300	H	75	175	350	90	3/27/96	74
R	11	13R-31L	1953	1985	3-5			6	6		75	200+	370	CBR=15	H	75	175	350	90	3/27/96	106
R	12	13R-31L	1952	1985	3.5-5.5	12		1	6	14.3	75	185	360	K=300	H	75	175	350	90	3/27/96	100
R	13	13R-31L	1952	1985	7.5-9.5	12		7		16.3	75	200+	400+	K=300	H	75	175	350	90	3/27/96	100
R	14	13R-31L	1952	1985	.5-11.	12		7		17.3	75	200+	400+	K=300	H	75	175	350	90	3/27/96	100
R	15	13R-31L	1953	1985	3-5			6			75	120	195	CBR=15	H	75	175	350	90	3/27/96	56
SR	1	13L-31R	1944	1968	2-5	9		6		13	75	200+		K=300	L	20			90	3/27/96	100
SR	2	13L-31R	1968	1968	6-8			2			38 30	60		CBR=15	L	20			90	3/27/96	100
SR	3	13L-31R	1968	1968	4-7	9		6		14	32 50	60		CBR=15	L	20			90	3/27/96	100
SR	4	13L-31R	1968	1968	4-7	9		6			75	175		K=300	L	20			90	3/27/96	100
SR	5	13L-31R	1968	1968	5-6	9					20 30	120		CBR=15	L	20			90	3/27/96	100
E	1	A10	1944			9		6		9	60	75	150	K=300	H	75	175	350	80	3/27/96	43
E	2	A10 APRON	1944			9		6		9	60	75		K=300	MH	75	140		80	3/27/96	54
E	3	A10 APRON	1955		3			8			60	80		CBR=15	L	20			70	3/27/96	100
E	3A	A10 APRON	1955	1988	4.5-7			8			75	140		CBR=15	L	20			90	3/27/96	100
E	4	A10 APRON	1973		2			6			25	45		CBR=15	L	20			80	3/27/96	54
E	5	A9	1959		2-5	9		6	18	10.6	75	105	190	K=250	H	75	175	350	75	3/27/96	51
E	6	A9	1944			10		6		10	75	90	180	K=300	H	75	175	350	85	3/27/96	43
E	7	A9	1944			9		6		9	60	75	150	K=300	H	75	175	350	85	3/27/96	100
E	7A	E A8	1944	1968	2	9		6		10	75			K=300	L	20			80	3/27/96	86
E	8	A9	1981		4			4			35	60		CBR=15	M	50	70		90	3/27/96	86
E	9	A9	1955	1979	6			12			75	200	300	CBR=15	H	75	175	350	90	3/27/96	54
E	10	A9 APRON	1944			9		6		9	60	75		K=300	MH	75	140		80	3/27/96	43
E	11	S TXY A	1944			9		6		9	60	75	150	K=300	H	75	175	350	80	3/27/96	64
E	12	A9 APRON	1944			10			18	10	75	80		K=300	MH	75	140		70	3/27/96	54
E	13	A7 APRON	1944			9		6		9	60	75		K=300	MH	75	140		85	3/27/96	100
E	14	W A8	1968	1989	5.5			9			75	145		CBR=15	M	50	70		95	3/27/96	100
E	15	E A8	1973		2			4			20			CBR=18	L	20			90	3/27/96	100
E	16	W A7	1950	1986	10-12			4			75	200+	370	CBR=15	H	75	175	350	95	3/27/96	100
E	17	A6	1944			9		6		9	60	75	150	K=300	L	20			95	3/27/96	100
E	18	A5	1944			9		6		9	60	75	150	K=300	L	20			90	3/27/96	86
E	19	TXY A	1968	1991	7-8			6			75	195	300	CBR=15	H	75	175	350	95	3/27/96	104
E	19A	TXY A	1969	1987	7-10			9			75	200+	365	CBR=15	H	75	175	350	95	3/27/96	100
E	20	TXY A	1944	1987	5-8	9		9		15.5	75	200+	400+	K=300	H	75	175	350	95	3/27/96	100
E	20A	TERM APRN	1944	1987	8-14	9		6		20	75	200+	400+	K=300	H	75	175	350	95	3/27/96	100
E	21	TERM APRN	1969	1987	8-13			6			75	200+	400+	CBR=15	H	75	175	350	90	3/27/96	100
E	22	TERM APRN	1969	1987	8-12			12			75	200+	400+	CBR=15	H	75	175	350	80	3/27/96	100
E	23	TERM APRN	1969	1987	7-10			9			75	200+	400+	CBR=15	H	75	175	350	85	3/27/96	31
E	24	TERM APRN	1950	1983	3	6		12			75	200+	400+	CBR=15	H	75	175	350	85	3/27/96	90
E	24A	TERM APRN	1950	1987	6-9	6		6		7.5	45	55	110	K=300	H	75	175	350	90	3/27/96	90
E	24B	TERM APRN	1950	1991	6-9	6		6		13.5	75	165	315	K=300	H	75	175	350	90	3/27/96	71
E	25	TERM APRN	1972		4		0			13.5	75	165	315	K=300	H	75	175	350	60	3/27/96	
											75	150	250	CBR=20	H						

PACRIM GEOTECHNICAL INC.
GEOTECHNICAL ENGINEERING AND APPLIED EARTH SCIENCES

10700 Meridian Ave. N., Suite 210 • Seattle, WA 98133 • Phone: (206) 365-8770 • Fax: (206) 365-8405

March 1, 2001

Reid Middleton
728 - 134th Street SW Suite 200
Everett, Washington 98204

Attention: Mr. Randy Hall

Subject: Summary of Geotechnical Evaluation for
King County International Airport, Runway 13L-31R Rehabilitation
Boeing Field, Seattle, Washington
PacRim Project No. 030-009

This letter summarizes the results of our geotechnical evaluation for the King County International Airport, Runway 13L-31R Rehabilitation Project. The site is located at Boeing Field, as shown on the Vicinity Map, Figure 1. Our work was completed in general accordance with our subconsultant agreement with Reid Middleton dated January 31, 2001. Our scope of services included the following items.

a. Log 4 test pits excavated with a backhoe subcontracted by PacRim, at locations selected by Reid Middleton.

b. Complete laboratory tests, including gradations and moisture contents.

c. Complete 2 laboratory CBR tests to evaluate a representative subgrade CBR value for the runway vicinity.

d. Summarize the results of our work in a brief letter report.

Field Explorations
Four test pits (TP-1 through TP-4) were excavated on January 31, 2001, with a rubber-tired Cat 416C extendahoe that was supplied and operated by Northwest Excavating. Depths ranged from 8 to 11 feet below the existing ground surface. Locations were selected by Reid Middleton, and were approximately as shown on the Site and Exploration Plan, Figure 2.

Typical subsurface conditions consisted of fill over native soil. The fill was up to 1-1/2 feet thick, and included loose to dense silty sand and sand. Below the fill we encountered layered sand, silty sand, silt, and sandy silt. The sand was loose to medium dense, and the silty sand was loose. The silt and sandy silt were soft to medium stiff or medium dense.

Light to heavy groundwater seepage was encountered in TP-1, TP-2, and TP-4 at depths ranging from 3 to 8 feet. Seepage was not observed in TP-3 during the time it was open. There was moderate to heavy caving in all test pits, starting at depths of 1 to 7 feet and extending to the test pit termination depths.

The test pit logs in Figures 4 through 7 present a more detailed description of subsurface conditions. Figure 3 provides a key to symbols and terms used on the summary logs.

Laboratory Testing

Laboratory testing included determination of natural moisture content on all samples, 4 sieve analyses (gradation), 2 compaction tests (proctors), and 2 California Bearing Ratio (CBR) tests. The selection of which tests to do on which samples was based on our discussion with Reid Middleton. The moisture contents, sieves, and 1 proctor were completed by PacRim. The 2 CBR tests and 1 proctor were subcontracted to Rosa Environmental & Geotechnical Laboratory.

Moisture content results are presented on the test pit logs adjacent to sample notation. The results of other tests completed by PacRim are presented on Figures 8 and 9. The results of tests completed by Rosa are presented after Figure 9.

Discussion of CBR Tests

There are several parameters for a CBR test that can be varied (e.g., sample water content, dry density, and surcharge pressure to simulate the anticipated pavement section). We discussed these parameters with Reid Middleton, and agreed to run the tests using the following values.

- sample compacted at optimum moisture content
- sample compacted to 98 percent of the ASTM D-1557 maximum dry density
- surcharge equivalent to 18 inches of asphalt with a density of 150 pounds per cubic foot, resulting in a surcharge pressure of 225 pounds per square foot

The tests were completed in general accordance with ASTM D-1883. Piston stress versus penetration curves were corrected for concave upward shape. The corrected stress curves were then used to calculate the following CBR values for piston penetrations of 0.1 and 0.2 inches.

sample	CBR @ 0.1 inch penetration	CBR @ 0.2 inch penetration
TP-4/S-3	30	43
TP-1/S-3	30	39

The ASTM Standard says that if the CBR value at 0.2 inch penetration is greater than the value at 0.1 inch penetration, then the CBR value at 0.2 inch penetration should be used.

Some Geotechnical Considerations

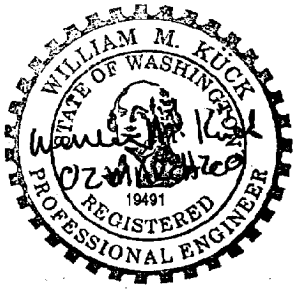
A primary geotechnical consideration for earthwork at this site is the moisture sensitivity of some of the on site soil. The silty sand and silt (whether fill or native) are highly moisture sensitive. They will be difficult, if not impossible, to work with and compact if they are much above optimum moisture content. The in situ moisture contents typically appeared to be wetter than optimum moisture content. Accordingly, the soil would likely have to be dried in order to be properly compacted. This would require dry, warm weather. It is not likely that the moisture sensitive soil could be placed and properly compacted in wet weather if it were not treated. Treatment of wet, moisture sensitive soil with kiln dust and/or portland cement may be an appropriate approach that would allow the use of on site soil as structural fill.

Limitations

Our scope of work was limited to field explorations and laboratory testing. Within the limitations of scope, schedule, and budget, we attempted to complete our services in accordance with generally accepted professional principles and practices in the field of geotechnical engineering at the time this letter was prepared. No warranty, express or implied, is made.

We trust this letter adequately summarizes the results of our geotechnical evaluation for the King County International Airport, Runway 13L-31R Rehabilitation Project, and provides you with the information you require at this time. If you have any comments or questions, please call.

PACRIM GEOTECHNICAL INC.



EXPIRES 07/28/2002

William M. Kück, P.E.
Senior Engineer

LIST OF FIGURES (FOLLOWING TEXT)

Figure 1	Vicinity Map
Figure 2	Site and Exploration Plan
Figure 3	Key to Exploration Logs
Figures 4 to 7	Logs of Test Pits TP-1 through TP-4
Figures 8 and 9	Results of Laboratory Tests by PacRim (4 sieves, 1 proctor)
Following Figure 9	Results of Laboratory Tests by Rosa (2 CBRs, 1 proctor)

3 copies submitted

PACRIM GEOTECHNICAL INC.

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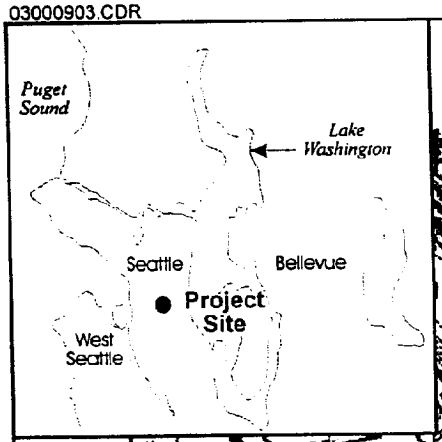


SOURCE: Printed from USGS Topographic Maps (www.terraserver.com)

N

SCALE IN FEET

0 1,200 2,400

Boeing Field Runway 13L-31R Rehabilitation
Seattle, WA
for King County

PACRIM GEOTECHNICAL INC.
GEOTECHNICAL ENGINEERING AND APPLIED EARTH SCIENCES

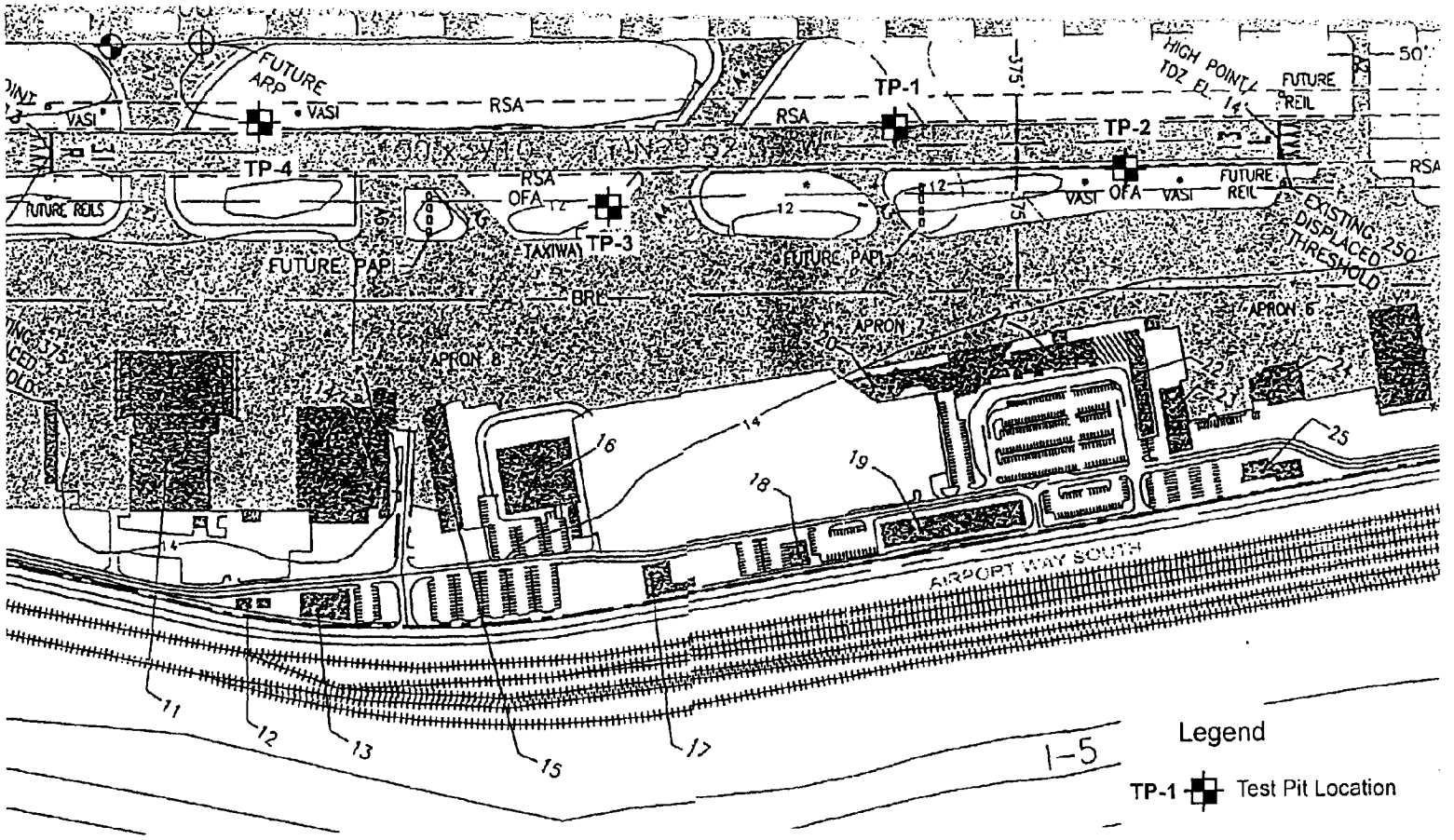
VICINITY MAP

Project No.: 030-009

Figure 1

KCSlip4 36756

SEA403301



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GEOTECHNICAL ENGINEERING AND APPLIED EARTH SCIENCES

Scale in feet
0 400 800 N

SITE AND EXPLORATION PLAN
Boeing Field Runway 13L-31R Rehabilitation
Seattle, WA
Project No.: 030-009 Figure 2

KCSlip4 36757

SEA403302

RELATIVE DENSITY OR CONSISTENCY VERSUS SPT N-VALUE

COHESIONLESS SOILS			COHESIVE SOILS		
Density	N (blows/ft)	Approximate Relative Density (%)	Consistency	N (blows/ft)	Approximate Undrained Shear Strength (psf)
Very Loose	0 to 4	0 - 15	Very Soft	0 to 2	<250
Loose	4 to 10	15 - 35	Soft	2 to 4	250 - 500
Medium Dense	10 to 30	35 - 65	Medium Stiff	4 to 8	500 - 1000
Dense	30 to 50	65 - 85	Stiff	8 to 15	1000 - 2000
Very Dense	over 50	85 - 100	Very Stiff	15 to 30	2000 - 4000
			Hard	over 30	>4000

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP DESCRIPTIONS	
Coarse Grained Soils More than 50% Retained on No 200 Sieve Size	Gravel and Gravelly Soils More than 50% of Coarse Fraction Retained on No. 4 Sieve	Clean Gravel (little or no fines)	GW	Well-graded GRAVEL
			GP	Poorly-graded GRAVEL
		Gravel with Fines (appreciable amount of fines)	GM	Silty GRAVEL
			GC	Clayey GRAVEL
	Sand and Sandy Soils 50% or More of Coarse Fraction Passing No. 4 Sieve	Clean Sand (little or no fines)	SW	Well-graded SAND
			SP	Poorly-graded SAND
		Sand with Fines (appreciable amount of fines)	SM	Silty SAND
			SC	Clayey SAND
Fine Grained Soils 50% or More Passing No. 200 Sieve Size	Silt and Clay Liquid Limit Less than 50%		ML	SILT
			CL	Lean CLAY
			OL	Organic SILTor CLAY
	Silt and Clay Liquid Limit 50% or More		MH	Elastic SILT
			CH	Fat CLAY
			OH	Organic SILTor CLAY
Highly Organic Soils			PT	PEAT

DESCRIPTORS FOR SOIL STRATA AND STRUCTURE

General Thickness or Spacing		Structure		General Attitude	
Parting:	less than 1/16 in.	Pocket:	Erratic, discontinuous deposit of limited extent	Near horizontal:	0 to 10 deg.
Seam:	1/16 to 1/2 in.	Lens:	Lenticular deposit	Low angle:	10 to 45 deg.
Layer:	1/2 to 12 in.	Varved:	Alternating seams of silt and clay	High angle:	45 to 80 deg.
Stratum:	greater than 12 in.	Laminated:	Alternating seams	Near vertical:	80 to 90 deg.
Scattered:	less than 1 per ft.	Interbedded:	Alternating layers		
Numerous:	more than 1 per ft.				

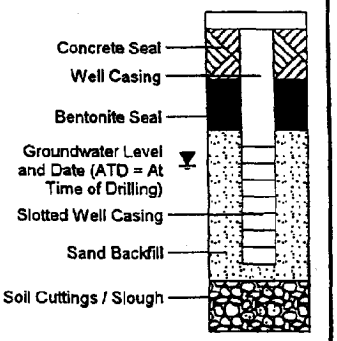
LABORATORY TEST SYMBOLS

AL	Atterberg Limits
FC	Fines Content
GSD	Grain Size Distribution
MC	Moisture Content
MD	Moisture Content/Dry Density
Comp	Compaction Test (Proctor)
SG	Specific Gravity
CBR	California Bearing Ratio
RM	Resilient Modulus
Perm	Permeability
TXP	Triaxial Permeability
Cons	Consolidation
VS	Vane Shear
DS	Direct Shear
UC	Unconfined Compression
TXS	Triaxial Compression
HYD	Hydrometer
UU	Unconsolidated, Undrained
CU	Consolidated, Undrained
CD	Consolidated, Drained

SAMPLE TYPE SYMBOLS

- Std. Penetration Test (2.0" OD)
- Ring Sampler (3.25" OD)
- California Sampler (3.0" OD)
- Undisturbed Tube Sample
- Grab Sample
- Core Run
- Non-standard Penetration Test (with split spoon sampler)

GROUNDWATER WELL COMPLETIONS



Notes:

1. Sample descriptions in this report are based on visual field and laboratory observations, which include density/consistency, moisture condition, grain size, and plasticity estimates, and should not be construed to imply field nor laboratory testing unless presented herein. Visual-manual classification methods of ASTM D 2488 were used as an identification guide. Where laboratory data are available, soil classifications are in general accordance with ASTM D 2487.

2. Solid lines between soil unit descriptions indicate change in interpreted geologic unit. Dashed lines indicate stratigraphic change within the unit.

Boeing Field Runway 13L-31R Rehabilitation
Seattle, WA

For King County

PACRIM GEOTECHNICAL INC.

GEOTECHNICAL ENGINEERING AND APPLIED EARTH SCIENCES

KEY TO EXPLORATION LOGS

Project No. 030-009

FIGURE 3

KCSlip4 36758

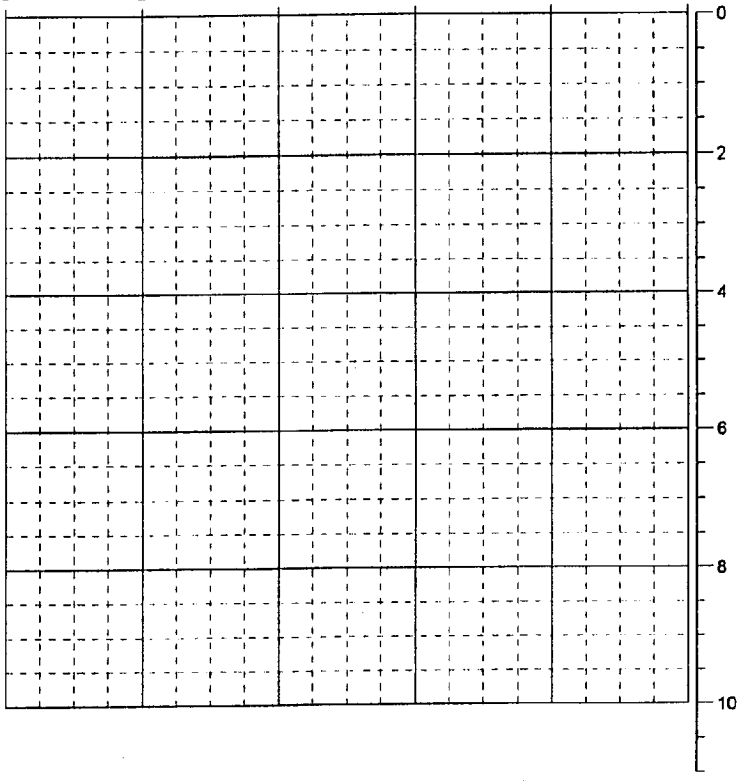
SEA403303

EXCAVATION COMPANY: Northwest Excavating
EQUIPMENT: CAT 416C Turbo 4x4 Extend-a-Hoe
SURFACE ELEVATION:

DATE COMPLETED: 1/31/01
LOGGED BY: CJN

Depth (feet)	Symbol	USCS	DESCRIPTION	Sample	Sample No.	Moisture Content (%)	Other Tests	Groundwater
0			1 to 2 inches of grass/sod.					
		SM	Dense, light brown, silty, fine to coarse SAND, little fine to coarse gravel, trace organics; moist. (FILL)	G	1	11.1		
2		SM	Loose, brown, silty fine SAND, trace medium sand, trace organics, trace shell fragments, pockets of sandy silt; moist.	G	2	23.9		
		SP	Loose, brown, fine to medium SAND, trace silt, trace coarse gravel, little andesite grains; moist.	G	3	18.2	GSD Comp CBR	
4		SM	Loose, gray, silty fine SAND; moist to wet.					
		ML	Soft, gray SILT, trace fine sand, scattered organic seams; wet.	G	4	46.7		
6								
8			Test pit completed at 8 feet. Light to moderate seepage from 4 to 4.5 feet. Moderate caving from 4 to 8 feet.					
10								

SKETCH OF SIDE OF PIT



PACRIM GEOTECHNICAL INC.
GEOTECHNICAL ENGINEERING AND APPLIED EARTH SCIENCES

Boeing Field Runway 13L-31R Rehabilitation
Seattle, WA
For King County

LOG OF TEST PIT
TP-1
Project No. 030-009
FIGURE 4

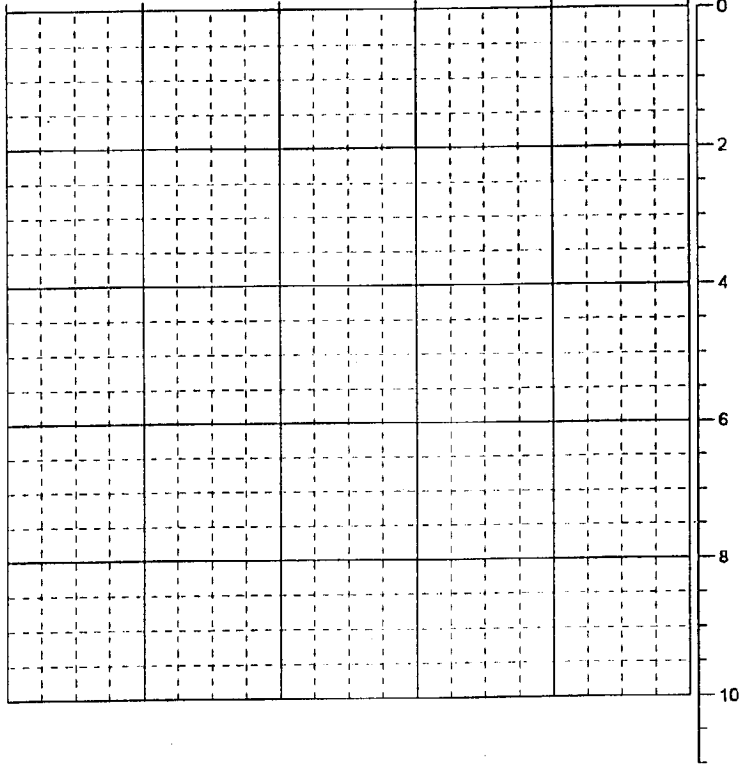
KCSlip4 36759
SEA403304

EXCAVATION COMPANY: Northwest Excavating
EQUIPMENT: CAT 416C Turbo 4x4 Extend-a-Hoe
SURFACE ELEVATION:

DATE COMPLETED: 1/31/01
LOGGED BY: CJN

Depth (feet)	Symbol	USCS	DESCRIPTION	Sample	Sample No.	Moisture Content (%)	Other Tests	Groundwater
0			1 to 2 inches of grass/sod.					
		SM	Loose, brown, silty, fine to coarse SAND, little gravel, some brick fragments, rock fragments, cinders; moist. (FILL)	G	1	32.4		
2		SP	Loose, brown, fine SAND, trace silt; moist.	G	2	21.9	GSD	
4		SP	Loose, gray, fine SAND, trace silt; wet.					
6		SP	Loose, brown/black fine to medium SAND, little andesite grains, trace silt; wet.					▼
8			Test pit completed at 8 ft. Slight seepage at 3 feet. Heavy seepage at 7 feet. Heavy caving from 2 to 8 feet.					
10								

SKETCH OF SIDE OF PIT



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Boeing Field Runway 13L-31R Rehabilitation
Seattle, WA
For King County

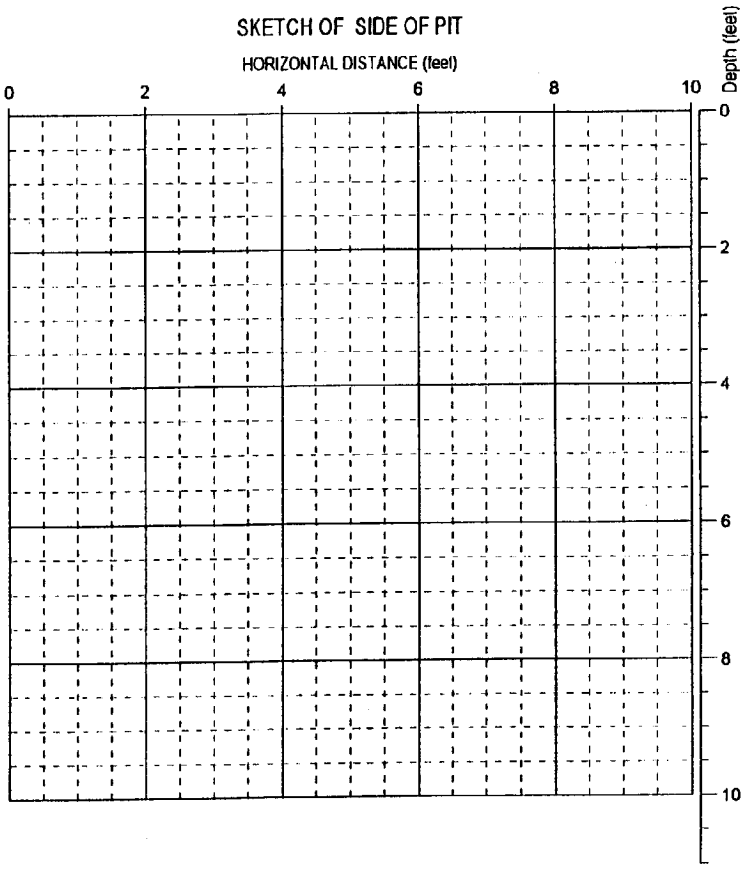
LOG OF TEST PIT
TP-2
Project No. 030-009
FIGURE 5

KCSlip4 36760
SEA403305

EXCAVATION COMPANY: Northwest Excavating
EQUIPMENT: CAT 416C Turbo 4x4 Extend-a-Hoe
SURFACE ELEVATION:

DATE COMPLETED: 1/31/01
LOGGED BY: CJN

Depth (feet)	Symbol	USCS	DESCRIPTION	Sample	Sample No.	Moisture Content (%)	Other Tests	Groundwater
0			1 to 2 inches of grass/sod.					
		SP	Medium dense, brown, fine to medium SAND, little andesite grains, occasional organics/wood fragments, trace silt; moist.					
2			Sandy SILT parting at 1.5 feet.	G	1	8.9	GSD	
4		ML	Medium dense, brown, fine sandy SILT, moist.	G	2	37.8		
6								
8			Becomes wet at 8 feet.					
10			Test pit completed at 8.5 feet. No seepage encountered. Heavy caving from 1 to 8 feet. 6 to 10 inch diameter vertical tree encountered in south side of excavation.					



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GEOTECHNICAL ENGINEERING AND APPLIED EARTH SCIENCES

Boeing Field Runway 13L-31R Rehabilitation
Seattle, WA
For King County

LOG OF TEST PIT
TP-3
Project No. 030-009
FIGURE 6

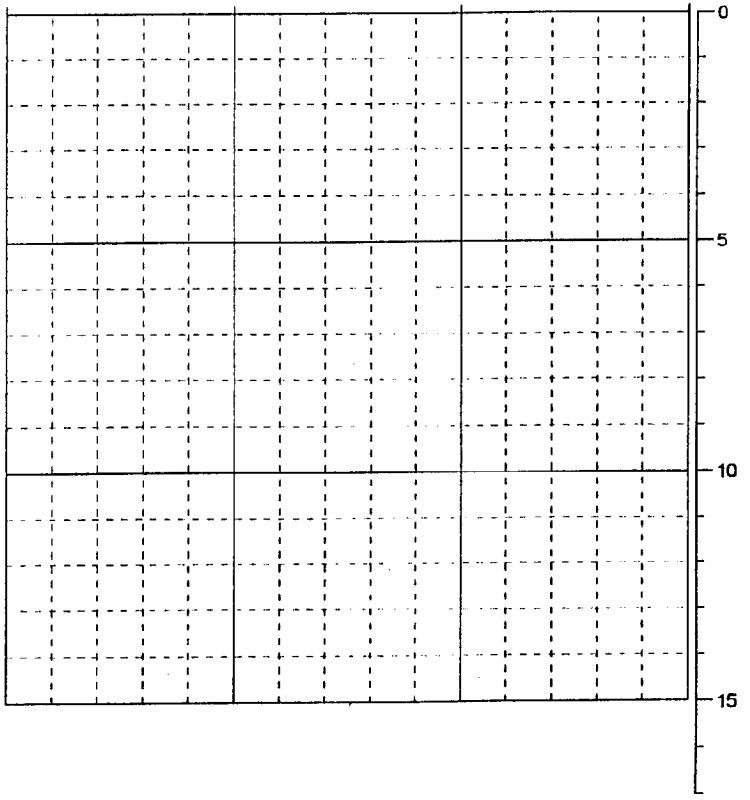
KCSlip4 36761
SEA403306

EXCAVATION COMPANY: Northwest Excavating
EQUIPMENT: CAT 416C Turbo 4x4 Extend-a-Hoe
SURFACE ELEVATION:

DATE COMPLETED: 1/31/01
LOGGED BY: CJN

Depth (feet)	Graphic Symbol	USCS	DESCRIPTION	Sample	Sample No.	Moisture Content (%)	Other Tests	Groundwater
0		SP	1 to 2 inches of grass/sod.					
		ML	Dense brown, fine to medium SAND, trace silt, coarse sand, fine gravel; moist. (FILL)	G	1	46.5		
			Medium dense, black SILT, trace fine sand, trace organics; moist.	G	2	49.5		
		ML	Medium stiff, brown SILT, trace fine sand, scattered organics; moist.					
5		SP ML	Loose mottled rust/orange, fine to medium SAND, trace silt; and pockets medium dense, gray sandy silt; moist.	G	3	37.4	GSD Comp CBR	
		ML	Medium dense gray SILT with sand, scattered rusty fine sand and silt pockets, trace organics; wet.					▼
10				G	4	32.9		
15			Test pit completed at 11 feet. Heavy seepage at 8 feet. Moderate caving from 7 to 11 feet.					

SKETCH OF SIDE OF PIT



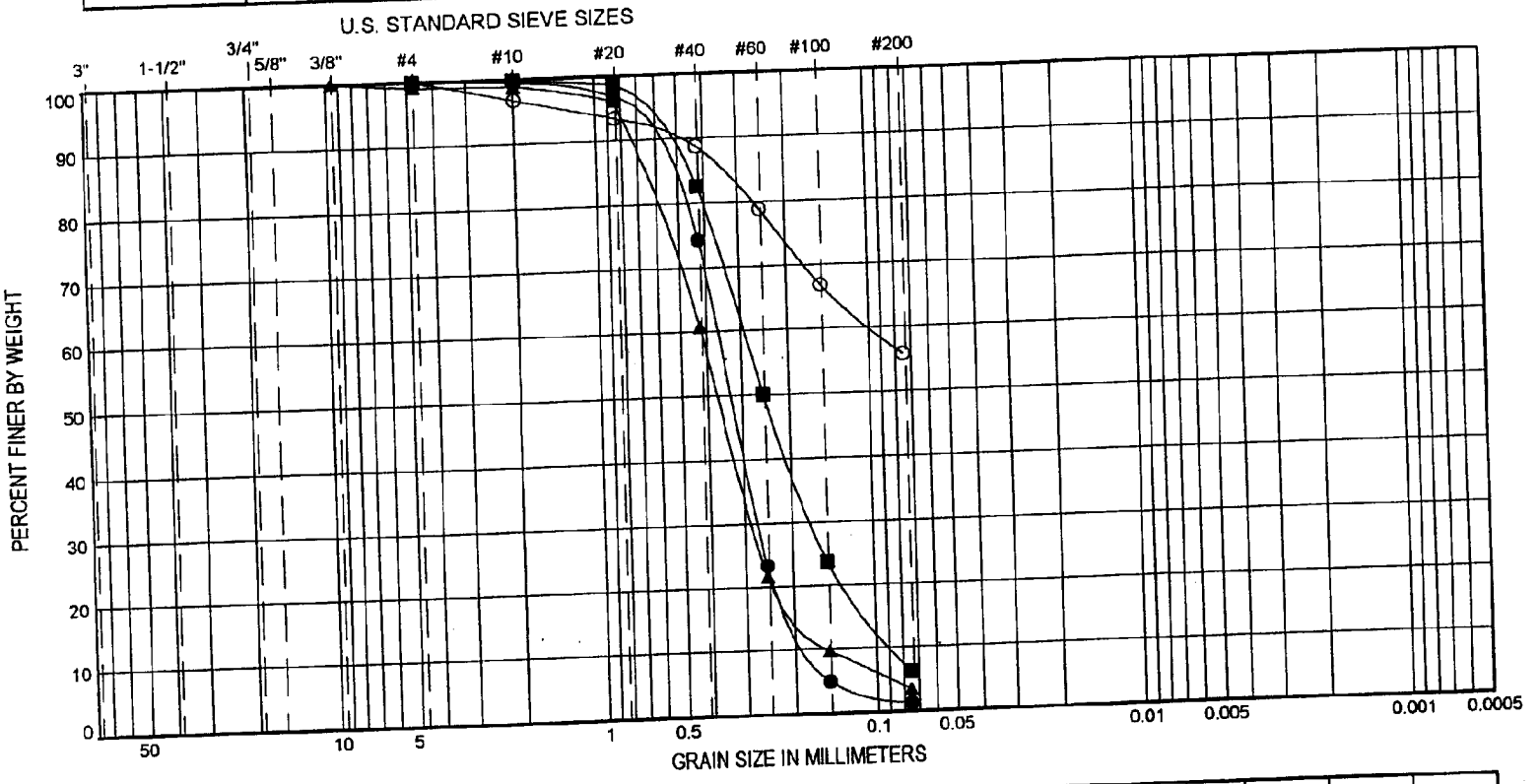
PACRIM GEOTECHNICAL INC.
GEOTECHNICAL ENGINEERING AND APPLIED EARTH SCIENCES

Boeing Field Runway 13L-31R Rehabilitation
Seattle, WA
For King County

LOG OF TEST PIT
TP-4

Project No. 030-009
FIGURE 7

KCSlip4 36762
SEA403307



SYMBOL	SAMPLE		DEPTH (ft)	CLASSIFICATION	% MC	LL	PL	PI	% Gravel	% Sand	% Fines
●	TP-1	3	2.5 - 3.5	Dark brown, medium to fine SAND, trace silt. (SP)	18				0	99	1
■	TP-2	2	1.0 - 3.0	Dark brown, medium to fine SAND, trace silt. (SP)	22				0	94	6
▲	TP-3	1	0.5 - 3.0	Dark brown, medium to fine SAND, trace silt and organics. (SP)	9				1	96	3
○	TP-4	3	6.0 - 7.0	Tan to light brown fine sandy SILT (ML)	37				0	44	56

PACRIM GEOTECHNICAL INC.
GEOTECHNICAL ENGINEERING AND APPLIED EARTH SCIENCES

Boeing Field Runway 13L-31R Rehabilitation
Seattle, WA
For King County

GRAIN SIZE ANALYSIS TEST RESULTS

Project No. 030-009

FIGURE 8

KCSlip4 36763

SEA403308

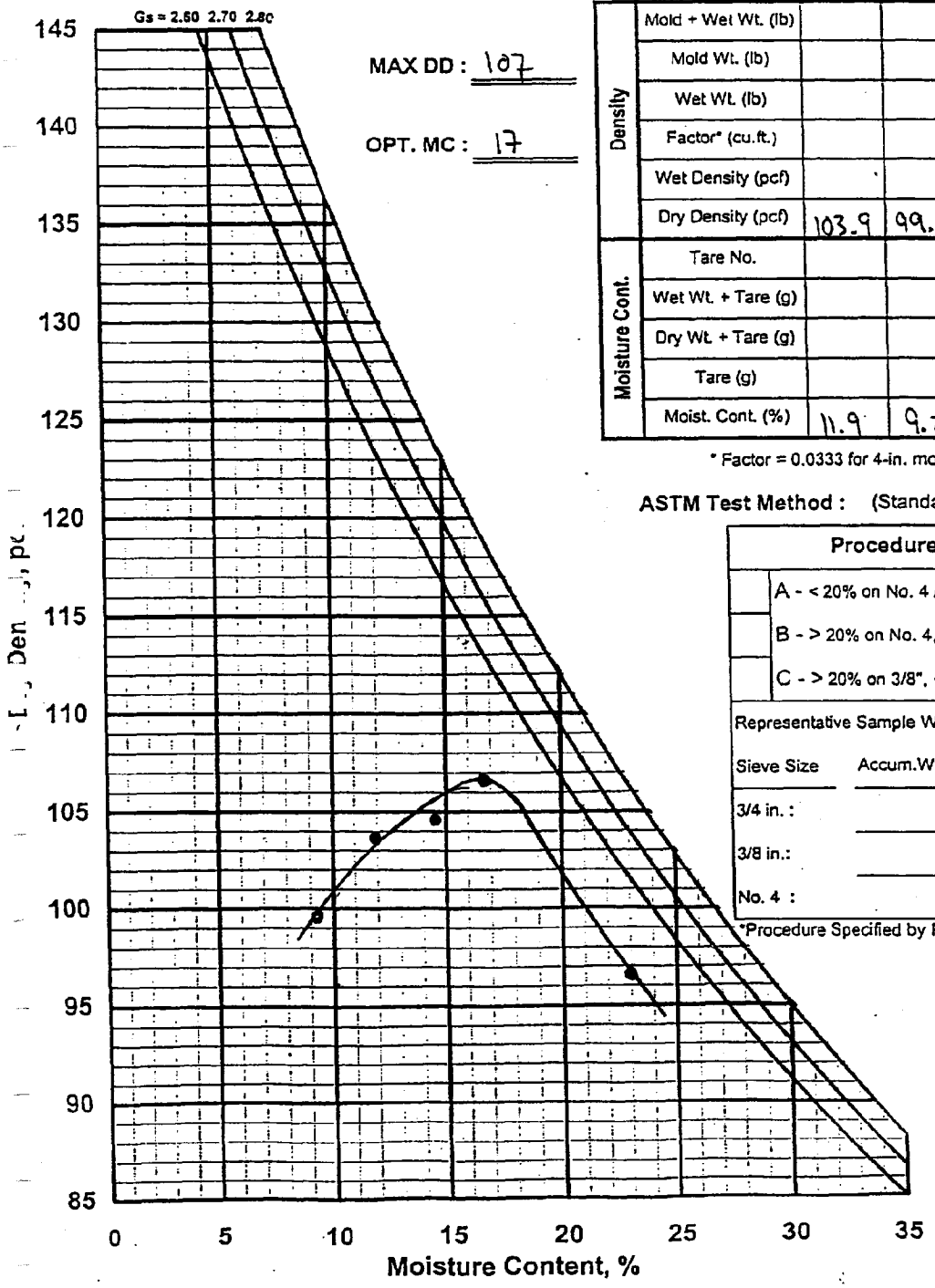
PACRIM GEOTECHNICAL INC.
GEOTECHNICAL ENGINEERING AND APPLIED EARTH SCIENCES

LABORATORY COMPACTION TEST

Project Name : King County Airport — Tested By : AM — Date : 2/7/01
Project No. : 030-009 — Checked By : WMC — Date : 09FEB2001
Exploration No. : TP-4 — Sample No. : S-3 — Depth (ft) : 6-7 ft
Description :

	Trial	1	2	3	4	5
Density	Mold + Wet Wt. (lb)					
	Mold Wt. (lb)					
	Wet Wt. (lb)					
	Factor* (cu.ft.)					
	Wet Density (pcf)					
	Dry Density (pcf)	103.9	99.8	104.4	106.8	96.7
Moisture Cont.	Tare No.					
	Wet Wt. + Tare (g)					
	Dry Wt. + Tare (g)					
	Tare (g)					
	Moist. Cont. (%)	11.9	9.2	14.5	16.7	23.0

* Factor = 0.0333 for 4-in. mold and 0.075 for 6-in. mold



ASTM Test Method : (Standard D698 / Modified D1557)

Procedure Determination*	
	A - < 20% on No. 4 / Use minus No. 4
	B - > 20% on No. 4, < 20% on 3/8 / Use minus 3/8"
	C - > 20% on 3/8", < 30% on 3/4" / Use minus 3/4"

Representative Sample Weight :

Sieve Size	Accum.Wt. Retained	Accum % retained
3/4 in. :		
3/8 in.:		
No. 4 :		

*Procedure Specified by Project Manager

ASTM Meth.	STD	MOD
Ham. Wt (lb)	5.5	10.0
Drop (in)	12	18
No. Layers	3	5
Procedure	A & B	C
Blow / Layer	25	56
Mold Dia (in)	4	6
Vol. (ft3)	0.0333	0.075

Revision No. 2
3/4/99

Proctor.xls

FIGURE 9

KCSlip4 36764

SEA403309

REG Lab WMBE
Rosa Environmental & Geotechnical Laboratory, LLC

1001 SW Klickitat Way, Suite 107
Seattle, WA 98134
(206) 287-9122

February 26, 2001

Mr. Bill Kuch
Pac Rim Geotechnical, Inc.
10700 Meridian Avenue North, Suite 210
Seattle, WA 98133-9008

Regarding: King County Airport, 030-009; REGL Project No. 1016-020

Dear Mr. Kuch;

The enclosed data tables and plots contain the CBR and Modified Proctor test data results you requested. Please call me if you have any questions or comments on the data or its presentation.

Best Regards,
Rosa Environmental & Geotechnical Laboratory, LLC

Harold Benny
Laboratory Manager

KCSlip4 36765

SEA403310

REG Lab WMBE
Rosa Environmental & Geotechnical Laboratory, LLC

1001 SW Klickitat Way, Suite 107
Seattle, WA 98134
(206) 287-9122

Client: PacRim Geotechnical, Inc.	REGL Project No.: 1016-020
Client Project No.: 030-009	Sample Batch No.: NA

Case Narrative

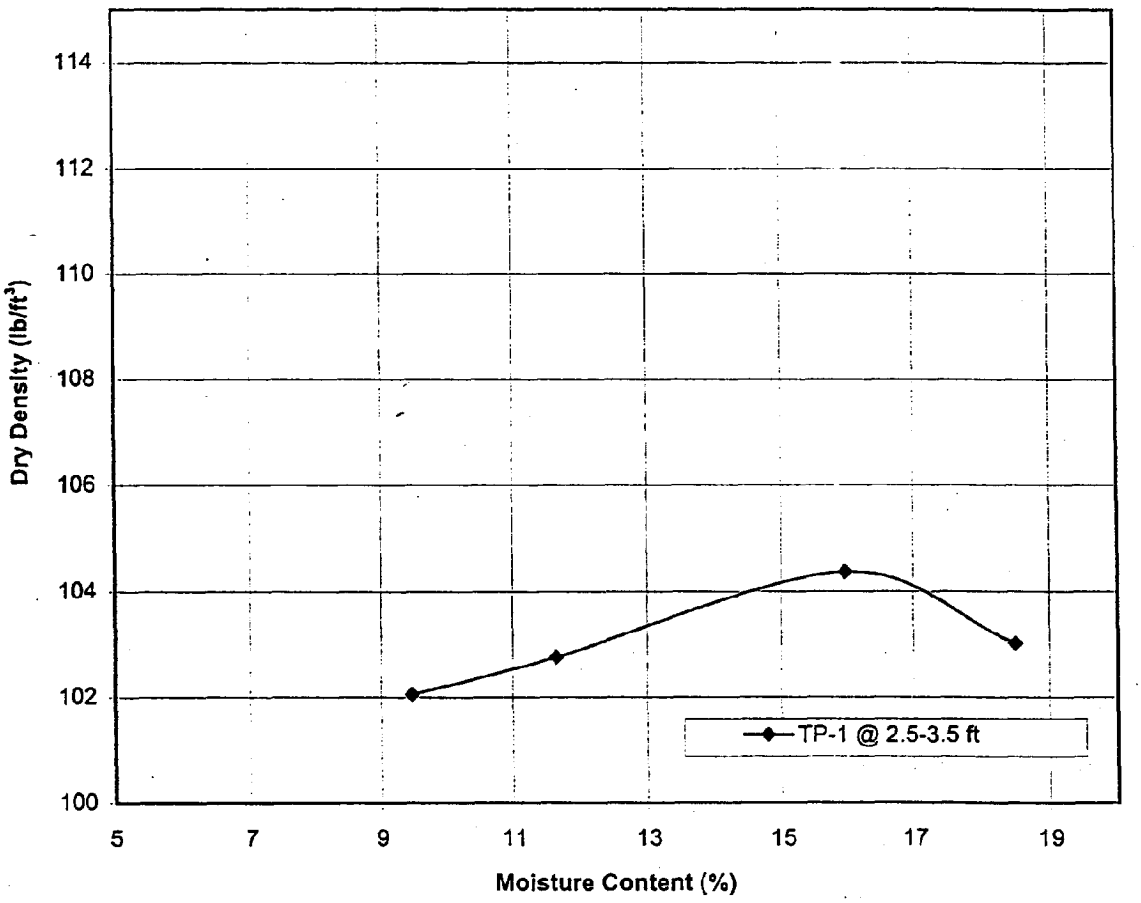
1. Two bulk bag samples were received on February 19, 2001 for CBR and modified Proctor testing. The testing was completed on February 26, 2001.
2. The CBR testing was run according to ASTM D-1883. The samples were pounded using 45 blows per lift to achieve the specified 98% of maximum Proctor density. The samples were soaked for three days while swelling measurements were taken. The sample from TP-1 drained considerable amounts of water during the test, which is reflected in the final moisture content of the top 1-inch layer.
3. The Proctor was run according to ASTM D-1557, method A. There was virtually no material retained on the ¼ inch sieve.
4. There were no anomalies to the samples or procedures.

Approved by: Harold Berry Date: 2/26/01
Title: Laboratory Manager

Moisture Density Relationship

ASTM D-1557, Method A

Client: PacRim Geotechnical, Inc. Date: 2/22/01
Project: King County Airport
Project No.: 030-009
Sample No.: Tp-1
Optimum Moisture Content: 15.9 %;
Maximum Dry Density: 104.4 lb/ft³
Notes: Sample was received wetter than optimum and was air dried

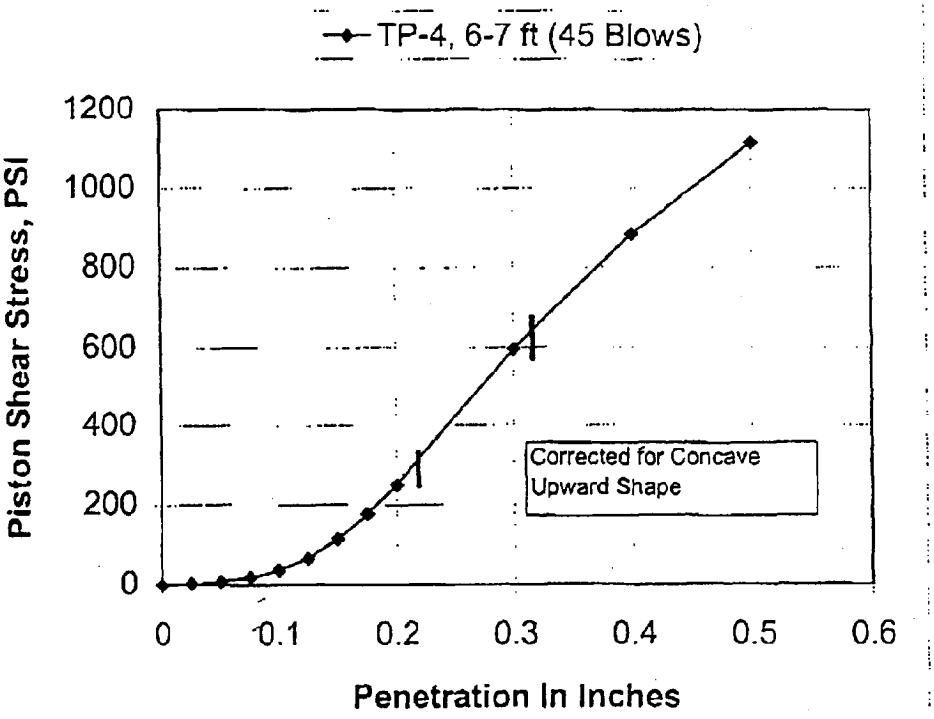


1007-001

Rosa Environmental and Geotechnical Laboratory, LLC

Pac Rim Geotechnical, Inc.
King County Airport, 030-009

Load Penetration Curve



Bearing Ratio at 0.1 Inch Penetration	3.6
Corrected Bearing Ratio at 0.1 Inch Penetration	30.0
Bearing Ratio at 0.2 Inch Penetration	16.7
Corrected Bearing Ratio at 0.2 Inch Penetration	43.0

Initial Dry Density, pcf	104.4
Initial Moisture Content, %	17.8
Percent Swell	0.41
Dry Density After Soak, pcf	103.9
Moisture Content After Soak, %	19.8
Moisture Content, Top 1 Inch After Test, %	20.1

1016-020

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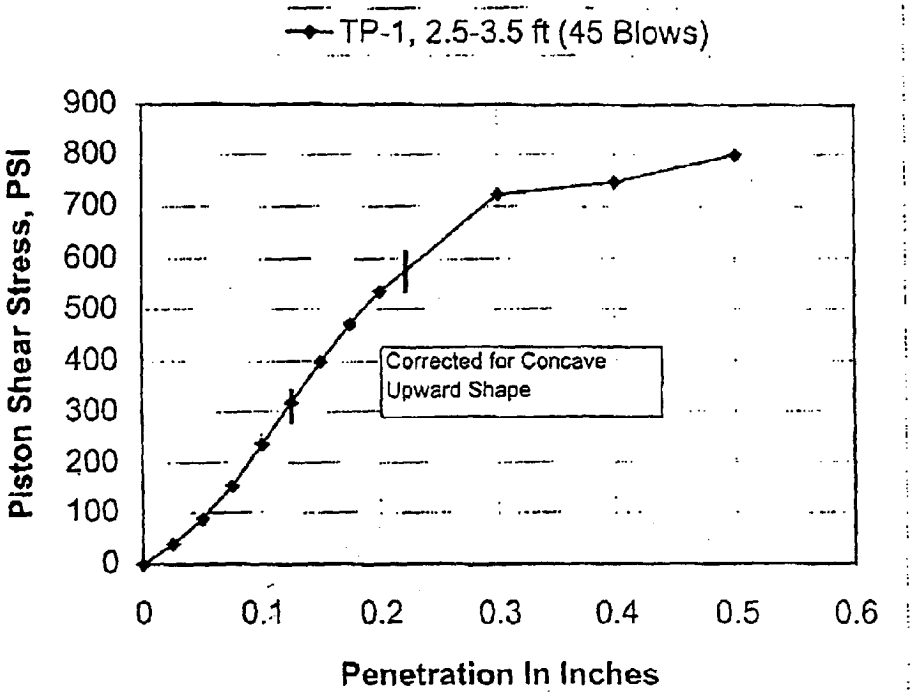
SEA403313

Rosa Environmental and Geotechnical Laboratory, LLC

Pac Rim Geotechnical, Inc.
King County Airport, 030-009

Load Penetration Curve



Bearing Ratio at 0.1 Inch Penetration	23.7
Corrected Bearing Ratio at 0.1 Inch Penetration	30.0
Bearing Ratio at 0.2 Inch Penetration	35.7
Corrected Bearing Ratio at 0.2 Inch Penetration	38.9

Initial Dry Density, pcf	101.4
Initial Moisture Content, %	16.5
Percent Swell (Shrinkage)	-0.31
Dry Density After Soak, pcf	101.7
Moisture Content After Soak, %	19.0
Moisture Content, Top 1 Inch After Test, %	18.3

1016-020

CIP ROUTING SLIP

Project Name: **Runway 13L-31 R Rehab**

Project Number: **001294**

1.0 Design

- ____ 1.1 Proposal/RFP
- ____ 1.2 Consultant Agreement
  - ____ 1.2.1 Bonds/Insurance
  - ____ 1.2.2 Amendments
  - ____ 1.2.3 Contract Documents
- ____ 1.3 Invoices/Progress Payments
- ____ 1.4 Incoming Correspondence
- ____ 1.5 Outgoing Correspondence
- ____ 1.6 Record of Conversations (Phone/E-Mail)
- X 1.7 Technical Reports
- ____ 1.8 Drawings

2.0 Construction

- ____ 2.1 Proposal/RFP
- ____ 2.2 Contract
  - ____ 2.2.1 Change Orders
  - ____ 2.2.2 Contract Documents/Drawings
  - ____ 2.2.3 Bonds/Insurance Certificates
  - ____ 2.2.4 Permits/Licenses
- ____ 2.3 Invoices/Progress Payment
- ____ 2.4 Incoming Correspondence
- ____ 2.5 Outgoing Correspondence
- ____ 2.6 Record of Conversations (Phone/Email)
- ____ 2.7 Quality Control/Technical Reports
- ____ 2.8 Schedules
- ____ 2.9 Record Documents (As-Built)
- ____ 2.9.A O&M Manuals
- ____ 2.9.B Photos
- ____ 2.9.C Certified Payrolls/State Prevailing Wage
  Name: _____
- ____ 2.9.D Field Notes (Misc)
- ____ 2.9.E Submittal No. _____

3.0 Outside Agencies

- ____ 3.1 Incoming Correspondence
- ____ 3.2 Outgoing Correspondence
- ____ 3.3 Record of Conversations (Phone/Email)
- ____ 3.4 Internal Correspondence
- ____ 3.5 Quality Control Reports
- ____ 3.6 Technical Reports
- ____ 3.7 External Funding Reports
- ____ 3.8 Agreements / MOUs

4.0 County Force Design

- ____ 4.1 Proposal/RFP/Scope of Work
- ____ 4.2 Work Authorization/Blanket Agreement
- ____ 4.3 Internal Correspondence
- ____ 4.4 Record of Conversations (Phone/Email)
- ____ 4.5 Technical Reports

5.0 County Force Administration

- ____ 5.1 Internal Correspondence
- ____ 5.2 Record of Conversations (Phone/Email)
- ____ 5.3 Project Closeout
- ____ 5.4 Field Notes (Misc)

Requested By & Date TW 1/2/03

Filed By & Date Jale 1-8-03

KCSlip4 36770

SEA403315

CIP ROUTING SLIP
PLANNING

Project Name: _____

Project Number: _____

6.0 Planning

_____ 6.1 Project Scoping and Goals
_____ 6.2 Project Budget
_____ 6.3 Consultant Services
_____ 6.4 Proposal/RFP
_____ 6.5 Studies/Plans
- ____ 6.5.1 Feasibility
- ____ 6.5.2 Pre-Design
- ____ 6.5.3 30 Percent Design

_____ 6.6 Coordination
- ____ 6.6.1 Department
- ____ 6.6.2 Agencies/Jurisdictions
- ____ 6.6.3 Community

_____ 6.7 Correspondence
_____ 6.8 Technical Reports/Maps
_____ 6.9 Plans